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ELECTRIC RAILWAY JOURNAL

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KEYSTONE CAR SPECIALTIES

were specified as standard equipment on Mr. Birney's famous Safety Car. They have contributed largely to the success of this car as well as thousands of other larger cars. Therefore, always specify these Keystone Car Specialties.

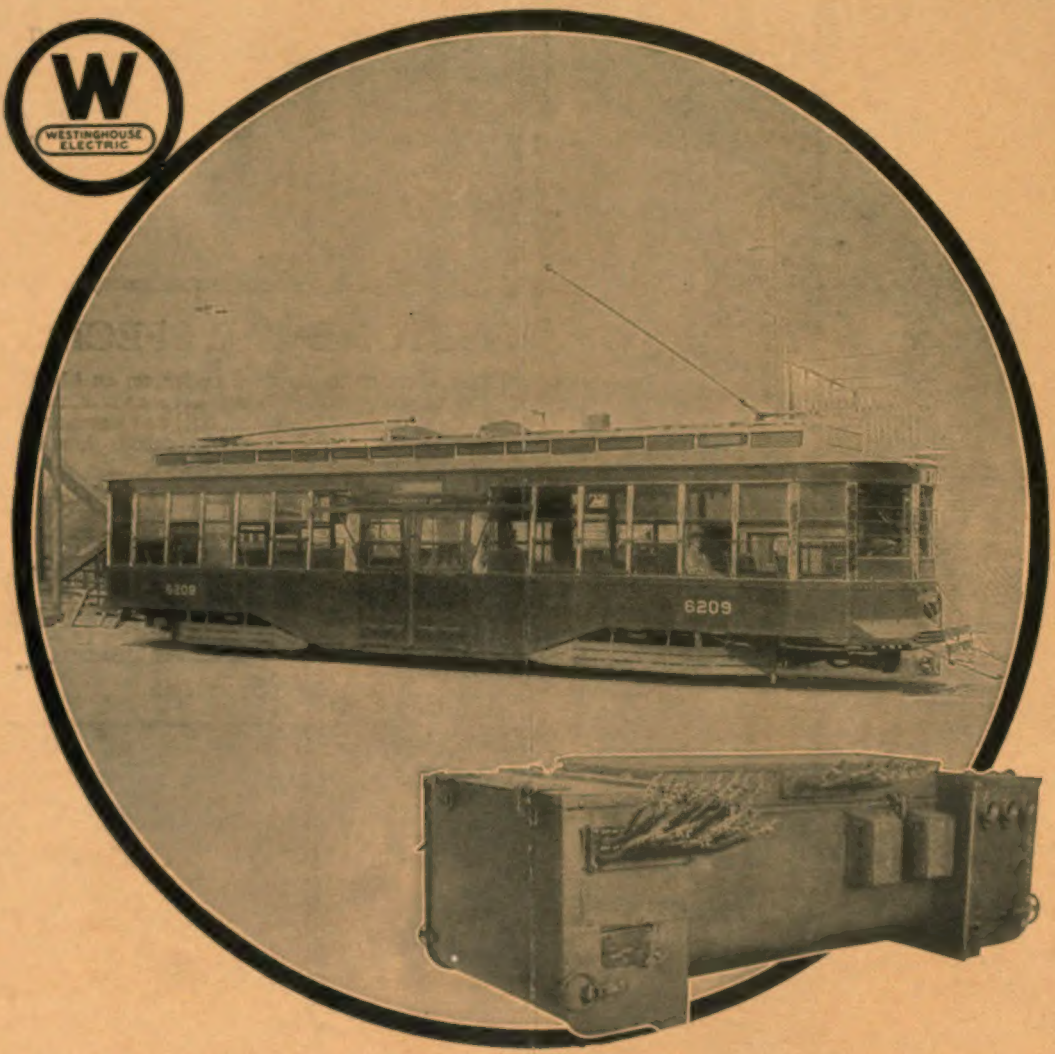
"Golden Glow" Incandescent Headlights
Illuminated Car Destination Signs
Faraday High Voltage Car Signals
Keystone Trolley Catchers
Keystone Air Sanders — Keystone Rotary Gongs

ELECTRIC SERVICE SUPPLIES CO.

Manufacturer of Railway Material

Philadelphia — New York — Chicago





One Hundred Equipments of HL Control and Westinghouse No. 514 Motors for New Low Floor Cars in Boston

Where severe congestion is encountered, relief will be found by the use of HL Control. It has gained achievements in every phase of railway work, and its ever increasing popularity is evidenced by its recent wide adoption for multiple-unit train service on surface lines in Boston, Milwaukee, and Northern Ohio.

Large numbers of Westinghouse No. 514 motors are rendering satisfaction and reliability in Philadelphia, Boston, Pittsburgh and many other cities, large and small, throughout the country.

Westinghouse Electric and Manufacturing Co.,
East Pittsburgh, Pa.

Westinghouse

Vol. 55, No. 10 New York, Saturday, March 6, 1920 *Pages 461–502*

Electric Railway Journal

H. W. BLAKE, *Editor*

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Westinghouse

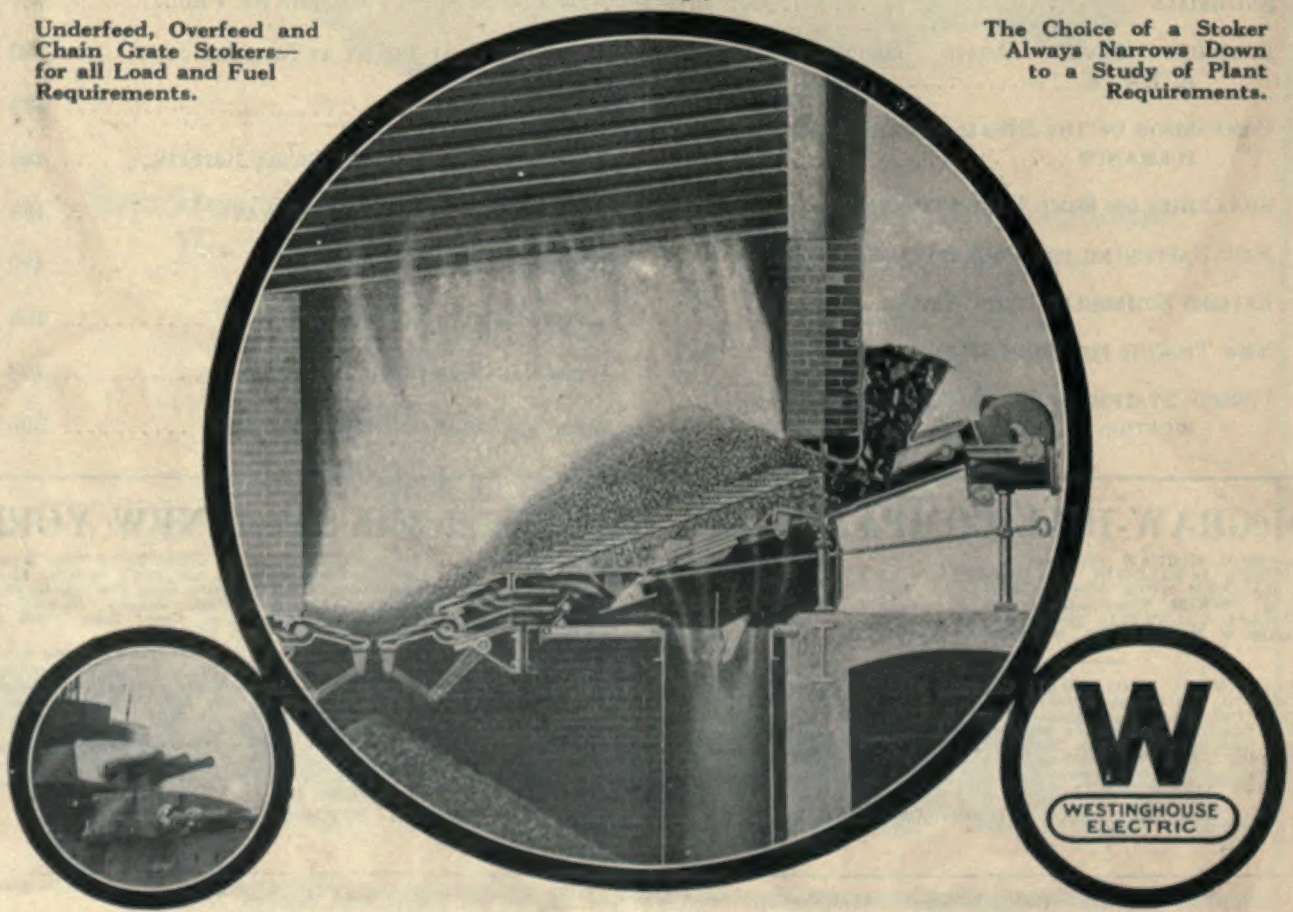
Underfeed Stokers in the Navy Yards—

Philadelphia, Pa.—U. S. Naval Aircraft	2 Stokers	1,486 Rated Boiler Horsepower
Indianhead, Md.—U. S. Naval Proving Grounds	6 Stokers	3,600 Rated Boiler Horsepower
Indianhead, Md.—U. S. Naval Proving Grounds	4 Stokers	1,412 Rated Boiler Horsepower
Newport, R. I.—U. S. Torpedo Station	4 Stokers	2,000 Rated Boiler Horsepower
Brooklyn, N. Y.—U. S. Navy Yards	16 Stokers	7,520 Rated Boiler Horsepower
Charleston, S. C.—U. S. Navy Yards	4 Stokers	1,900 Rated Boiler Horsepower
Hampton Roads, Va.—U. S. Navy Yards	4 Stokers	2,400 Rated Boiler Horsepower
Norfolk, Va.—U. S. Navy Yards	12 Stokers	7,200 Rated Boiler Horsepower
Philadelphia, Pa.—U. S. Navy Yards	12 Stokers	7,200 Rated Boiler Horsepower
Washington—U. S. Navy Yards	10 Stokers	3,000 Rated Boiler Horsepower
Annapolis, Md.—U. S. Navy Yards	12 Stokers	6,000 Rated Boiler Horsepower

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Underfeed, Overfeed and Chain Grate Stokers—for all Load and Fuel Requirements.

The Choice of a Stoker Always Narrows Down to a Study of Plant Requirements.



W
WESTINGHOUSE ELECTRIC

Westinghouse-Cleveland Trolley-Wire Splicer



For the past nine years the Westinghouse - Cleveland Splicer has been specified by many line superintendents.

Why?

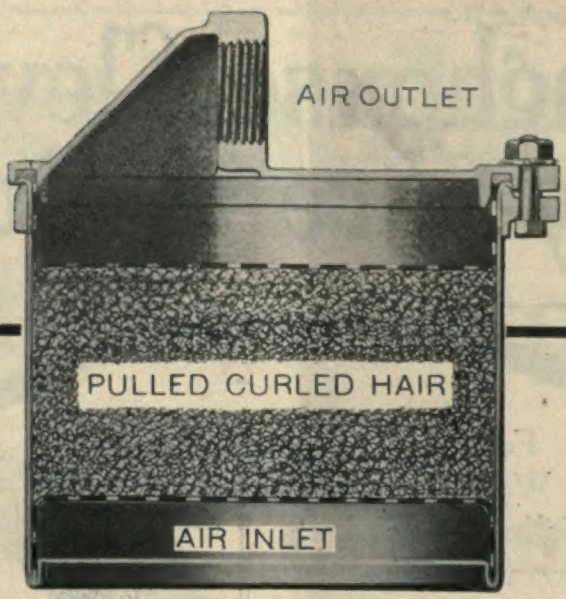
Because it is easily and quickly installed, is neat in appearance and adds to the strength of the trolley wire.

The Cleveland Splicer was first put on the market by the Westinghouse Electric Co. in 1909. It had such an immediate success that it was widely copied. Late improvements make the "Westinghouse - Cleveland" the latest word in splicers. It is a sound investment to have on the tower wagon. It is both an emergency and a permanent splicer, and will last longer than the trolley wire.

W
WESTINGHOUSE ELECTRIC

Westinghouse Electric & Manufacturing Company
EAST PITTSBURGH, PA.
Sales Offices in All Large American Cities

Westinghouse



An Efficient Air Strainer will add years to the Life of an Air Compressor.

Excluding dirt from the Air Compressor makes Perfect Lubrication Possible.

Efficiency and Longevity

are put into the Air Compressor by the new Westinghouse 8-Inch Air Suction Strainer. Its unusually large screening area permits intake air to pass so gently through it that all dirt and grit are deposited in the strainer and only clean air reaches the smoothly machined cylinder walls and delicately fitted piston packing rings of the compressor.

Air Brake Building Our Business For a Lifetime

Westinghouse Traction Brake Company

General Offices and Works: Wilmerding, Pa.

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Denver, Col.
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New York, N. Y.
Pittsburgh, Pa.
San Francisco
Seattle, Wash.
St. Louis, Mo.
St. Paul, Minn.



The Ten Points of Efficiency

The Story of

The Safety Car In a City of 66,000

1—Step accidents eliminated.
2—General accidents reduced.
3—Higher schedule speed makes 7 cars do the work of 8 and 8 cars the work of ten.
4—More good words and more patrons for the railway.
5—Jitney bus vamoosing.
6—City Government says "Give us more SAFETY CAR service."
7—Operators pleased with higher wages and easier riding cars.
8—More car miles with less Kw-hours.
9—Less car maintenance.
10—Less track upkeep.

And to conclude—

The operator said:
"It is not a small town car. It is what the name implies—a SAFETY CAR."

Why wait one day longer to order yours?

IT IS A SAFETY CAR ONLY

When equipped with automatic laborless apparatus, so interlocked that, regardless of the illness or distraction of the operator, the power will be cut off instantaneously, the air brakes and sander apply immediately thereafter and the doors unlatch for safe and easy exit. Furthermore, it is a Safety Car only when the doors must be closed and the step folded before the car can start, and when the airbrake must be applied before the doors are opened and the step lowered in bringing the car to a service stop.

SAFETY CAR DEVICES CO.

Main Office—Boatmen's Bank Bldg., ST. LOUIS

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PITTSBURGH
Westinghouse Bldg.

CANADA—Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Aluminum Feeders for Electric Railway Use

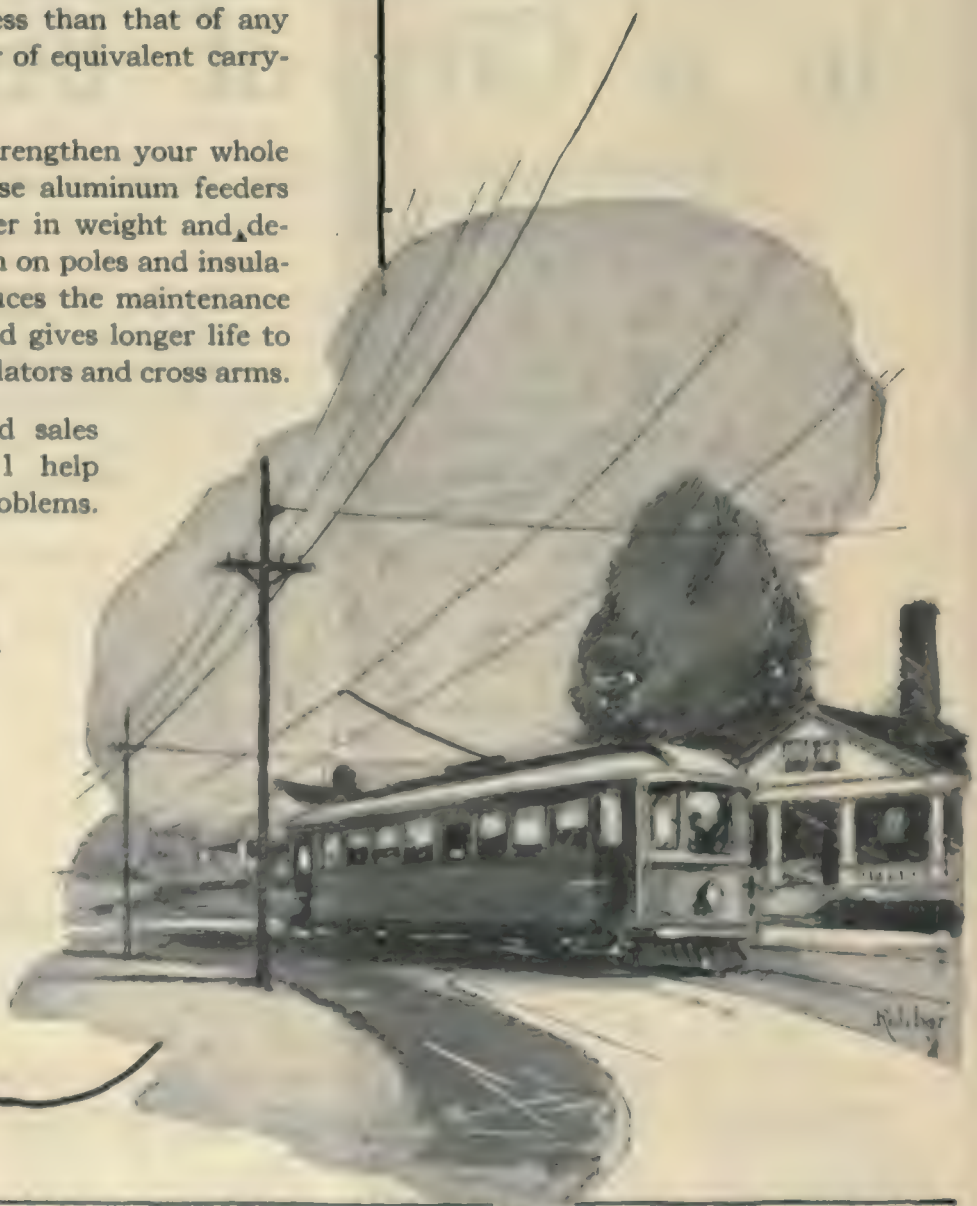
WHEN you equip lines with Aluminum Feeders you do two very distinct things.

First—You save money. The initial cost is much less than that of any other conductor of equivalent carrying capacity.

Second—You strengthen your whole pole line because aluminum feeders are much lighter in weight and decrease the strain on poles and insulators. This reduces the maintenance on your line and gives longer life to your poles, insulators and cross arms.

Our experienced sales engineers will help solve your problems.

Write for details.



Aluminum Company of America, General Offices, Oliver Bldg. Pittsburg, Pa. U.S.A.

PROCESS PUTS LIFE IN O-B EXTRUDED METAL EARS



O-B Extruded Ear on Grooved Wire



O-B Extruded Ear on Round Wire



O-B Extruded Ear on Fig. 8 wire

Extruded metal runner piece has endurance literally forced into the metal. Red hot (not molten) metal is rammed through a die by tremendous hydraulic force.

This process makes a tough, dense and ductile metal to absolutely uniform measurements.

A malleable iron sherardized boss is attached to extruded runner piece with five rivets making a one piece ear. The threads in malleable iron boss do not wear loose.

Thousands of O-B Extruded Metal Ears in service have made remarkable records. You would probably discount the praise of enthusiastic users until you tried these unique ears.

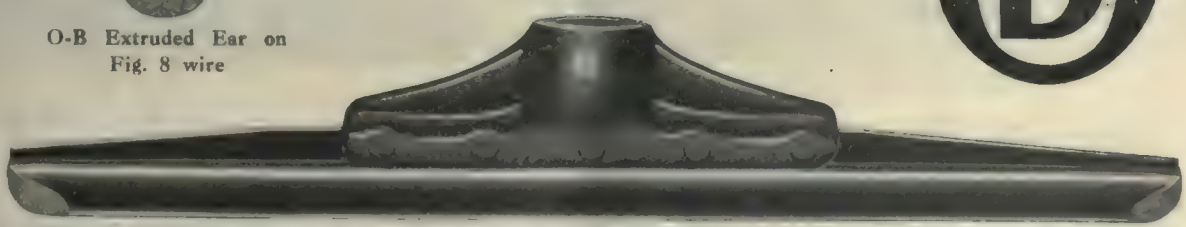
Order a few; stagger them on your line with present ears and let results talk.

Made for all sizes of Round, Grooved and Fig. 8 Wire.

THE OHIO BRASS COMPANY

Mansfield, Ohio

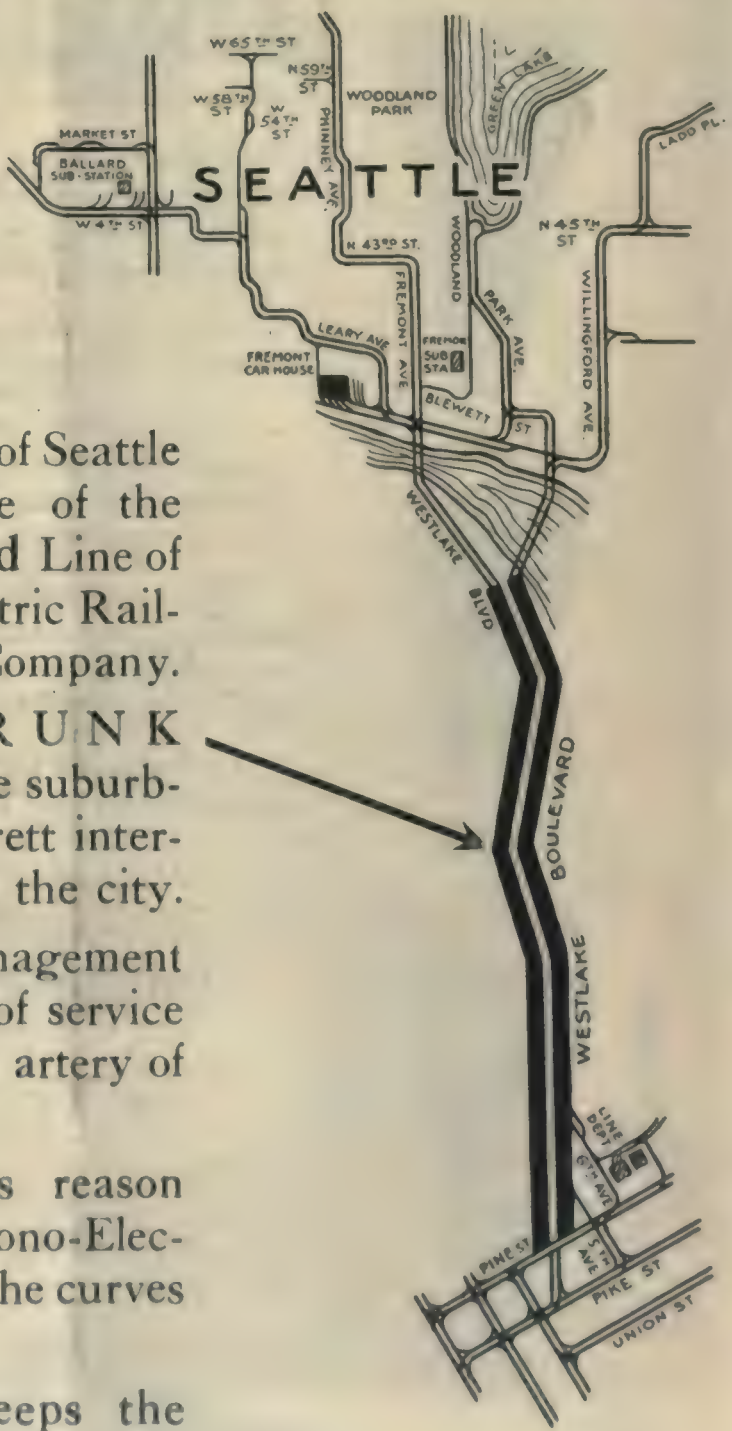
New York Chicago | Philadelphia Los Angeles | Pittsburgh San Francisco



O-B Extruded Ear (Patented)

Phono-Electric

Is Used here for Service Insurance



This map of a part of Seattle shows the importance of the **Westlake Boulevard** Line of the Puget Sound Electric Railway, Light & Power Company.

For it is the TRUNK over which SIX Seattle suburban lines and the Everett interurban line come into the city.

A progressive management doesn't take chances of service interruptions with an artery of that kind.

That's the obvious reason for using 00 round Phono-Electric Trolley Wire on the curves of this line.

Phono-Electric keeps the tower wagon off the track.

Bridgeport Brass Company
Bridgeport Connecticut

2075



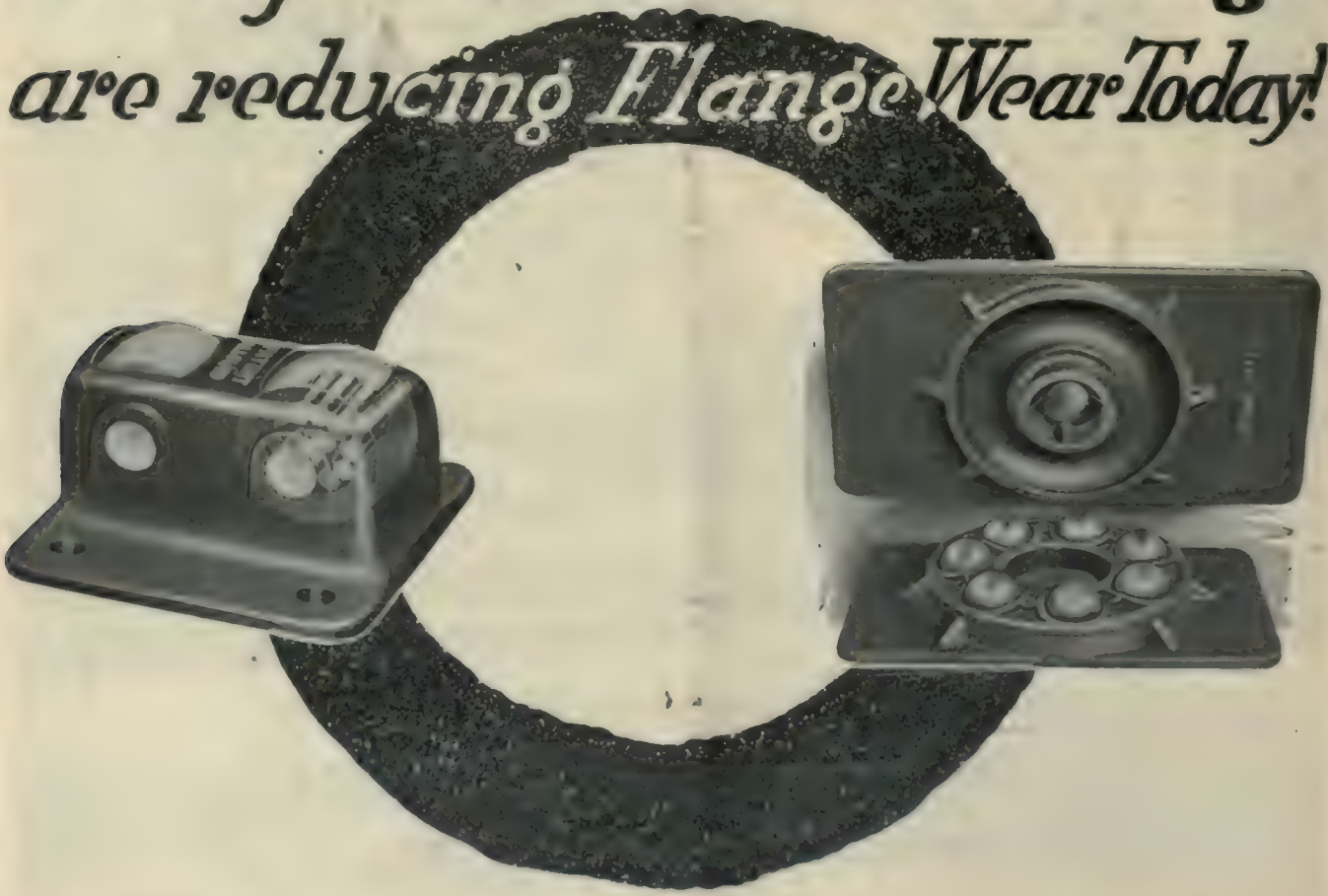
The International Steel Tie Company

Manufacturers of Steel Twin Ties and Crossing Foundations

General Sales Office and Works: Cleveland, Ohio

200,000 Perry-Hartman Bearings

are reducing Flange Wear Today!



Double the life of your wheels—cut your pull-ins for wheel renewals by fifty per cent, decrease nosing, lessen flange and rail wear, reduce power consumption on curves and eliminate curve lubrication costs by using Perry-Hartman Bearings.

Eighty-eight railways of the United States and Canada are securing these results today on both old and new equipment—their constant repeat orders are forcible testimony.

Perry-Hartman Bearings can be quickly and economically applied to old cars in place of plain friction center plates and side bearings. Send for Catalogue No. 10, showing applications.

Holden & White Inc.

Electric Railway Distributors for the Joliet Railway Supply Company

817 Fisher Building, Chicago

Eastern Representative, National Railway Appliance Co., New York and Washington

ANACONDA COPPER WIRE

From Mine to Finished Product

This is a partial view of the Anaconda Rolling Mills at Great Falls, Montana, the first plant of its kind to be built west of the Mississippi—erected solely for the purpose of giving users of copper wire a better service than has been heretofore obtainable.

All Anaconda Copper Wire drawn at this plant is made from well known B. & M. Brand Electrolytic Copper Bars of which the following is a representative analysis.

Copper	99.94% — 99.97%
Oxygen	.02% — .05%
Silver	.0010%
Gold	.00001%
Sulphur	.0030%
Iron	.0025%
Nickel	.0015%
Arsenic	.0015%
Antimony	.0020%

Note that the sum of the metallic impurities is less than 1/100 of 1%.

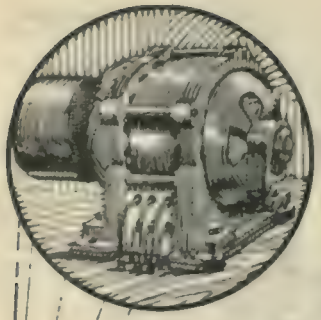
Allow our engineers to figure on your requirements



ANACONDA COPPER MINING COMPANY

Rolling Mills Dept. Great Falls, Mont.

General Office Rolling Mills Dept. Chicago



Rome-Wire

The Symbol of Efficiency in Electrical Conductors



HOT ROLLED COPPER AND BRONZE RODS

COPPER AND BRONZE BARE WIRE
Round, square and rectangular, plain and tinned

COPPER AND BRONZE TROLLEY WIRES
Round, grooved and figure eight

POWER CABLES
Solid and Stranded

ROUND EDGE FLAT COPPER WIRE

MAGNET WIRE
Round, square and rectangular
cotton covered
silk covered
enameled covered
enamel and cotton
enamel and silk



POLISHED COPPER PIANO COVERING WIRE

RUBBER INSULATED WIRE
Bridle wires
flexible cords
jumper wires
telephone wires
N. E. C. S. wire
fixture wires
heater cords

SPECIAL WIRES AND CABLES

GATHERING LOCOMOTIVE CABLE

GAS ENGINE CABLE

MINING MACHINE CABLE

WIRES AND CABLES FOR EXPORT

DECK CABLE

BREWERY CORD

AUTOMOBILE WIRES
Charging Cables, ignition wires
starter cable, lightning wire
horn wire

ROME WIRE CO.
ROME, N.Y.
U.S.A.

All Operations from Wire Bar to Finished Product in this Plant



NIGHT SCENE IN MISSOULA, MONTANA



A "White Way" in Your City on a Practical Basis

HERE is how the thriving and progressive community of Missoula, Montana, secured a "White Way" that has brought business to the merchants of the city.

The street railway company approached the Chamber of Commerce and the city fathers with a proposition to share in the expense of securing brilliant night illumination for the main thoroughfare, providing "Elreco" Combination Railway and Lighting Poles were made the means of securing the desired effects.

And the railway company actually sold this idea of the "White Way" to the city!

What did the railway company get out of it? Well, in the first place, permanent, tubular steel construction poles to carry their trolley span wires; second, the good-will of the merchants and the public generally because of their co-operation; and third, the increase of revenue passengers brought by the influx of new business following the installation.

It is essentially a practical plan—working in *your* city as well as in Missoula, Pittsburgh, Niagara Falls, Lynchburg and scores of other cities where it has been successfully done.

Write for Catalog "F" containing installation pictures taken in many American cities

Electric Railway Equipment Company

Cincinnati, Ohio

30 Church Street, New York City

The T.D.B. SYSTEM OF SIGNALING

TRAFFIC DIRECTION BLOCK



(Bulletin 69—T. D. B. System—on request).

Particular attention is called to the following summary of results to be obtained by the use of this system. This will doubtless appeal to the executive, operating and engineering departments of all interurban railways.

FIRST:—MAXIMUM PROTECTION:—Each car has at all times one or two stop signals protecting it at the rear as well as head-on.

SECOND:—MAXIMUM SPEED:—A proceed signal means that the block is unoccupied.

THIRD:—SIMPLICITY OF OPERATION:—Each signal gives but two indications, stop and proceed. All apparatus is operated automatically; therefore, trainmen do not need to manipulate any part of the signal system. All cars receive the same indication to pass into a block.

FOURTH:—FACILITY OF OPERATION:—A car receiving a clear signal can proceed without delay. Each block is a unit with clearly defined limits; the absence of preliminaries insures that a car in one block does not affect other cars in or approaching adjoining blocks. A car may, therefore, at any time proceed promptly to a siding or meeting point.

FIFTH:—SIMPLICITY OF RULES:—There are only two indications, stop and proceed, which are so easily understood that trainmen are favorably impressed and appreciate the fact that they can be observed without difficulty or confusion.

SIXTH:—SHORTEST POSSIBLE HEADWAY UNDER FULL PROTECTION:—Opposing or following cars are spaced a minimum safe distance apart. Under a system requiring preliminaries the spacing is increased at certain places by a distance equal to the length of the preliminary without securing additional safety. The fact that the length of the preliminary does not always bear a fixed relation to the length of the block and that the preliminary may be at either end, means that all signals do not give the same information.

SEVENTH:—HIGH EFFICIENCY:—Standard apparatus and simple controlling circuits are used throughout.

EIGHTH:—ADAPTABILITY TO CONDITIONS:—This system is applicable to all track and traffic conditions.

The Union Switch & Signal Co.

SWISSVALE, PA.

Trade Mark

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CHICAGO

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SAN FRANCISCO

Trade Mark

Represented by the GENERAL ELECTRIC CO. in Australasia, South Africa and Argentina



A man-sized drill that cuts track drilling costs

THIS track man is getting results that put old-time hand methods to shame. With this Little Giant he is saving 75% in time and labor costs over former hand methods.

The problem of quick and efficient track drilling is invariably solved when a Little Giant Electric Track Drill gets on the job. Portable, simple to operate, speedy and dependable, its use quickly proves the needlessness of costly, laborious hand drilling.

Little Giants make good "buddies" for your fastest track men. They will prove dividend payers if ordered in time for your Spring construction and repair program.

Ask for bulletins describing this and other Little Giant Portable Electric Tools.

Chicago Pneumatic Tool Company, 1062 Fisher Building, Chicago

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CHICAGO PNEUMATIC AIR COMPRESSORS · VACUUM PUMPS · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES · ROCK DRILLS · COAL DRILLS

LITTLE *Electric* **GIANT** *Tools*

EL-30



How is the life of the rail prolonged by the

Resiliency

of Dayton Mechanical Ties?

The cushion feature of Resilient Railway Ties allows just the right amount of rail deflection. Always the same; in the frozen ground of Winter or the soft thawing of Springtime. This lessens rail crystallization.

The joint tie supports the rail ends from the base of the rails and on exactly the same level. Broken down joints and battered rail ends impossible.

THE DAYTON MECHANICAL TIE CO., 704 COMMERCIAL BLDG., DAYTON, OHIO

The Dynamotor

Portable Bonder and Welder



An organized and well established company who are aiding the Electric Railway Industry by solving problems in rail bonding, track welding and shop welding.

The Rail Welding & Bonding Company

Cleveland, Ohio, U. S. A.

(OVER)

DO ALL Electric Welding WITH THE DYNAMOTOR



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BURTON R. STARE COMPANY - 325 Yesler Way, Seattle, Wash.
A. A. WIGMORE, - - 441 Pacific Elec. Bldg., Los Angeles, Calif.



An 18-foot "Acme" Culvert could be shipped by airplane

If there is any conveyance in which space is limited, then it must be in a double seater Curtis JN-4 airplane. There's barely enough room for two people. Yet 18 ft. of 15-inch

"ACME" (NESTABLE) Anti-Corrosive Corrugated CULVERTS

Galvanized

could easily be carried instead of a second passenger. The illustration shows the "ACMES" being loaded into the rear cockpit.

Think! An 18-ft. culvert in such a small space. It's possible because "ACMES" come in sections. Each upper and lower section is 2 ft. long. This makes them easier to load, haul and install than culverts already set up.

Only two men are needed to load, unload and install even the largest sizes of "ACMES," such as 60 in. and 72 in. And they're easy to set up — you merely place one section on top of another and bolt them together. An ordinary farm wagon can be used to haul them from "station to destination."

"ACMES" are made from "No-Co-Ro"— that famous pure iron. They resist rust.

We will be glad to send Folder M-21. It tells all about "ACMES."

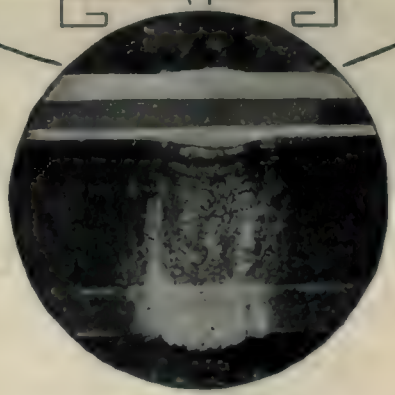
THE CANTON CULVERT & SILO CO.
MANUFACTURERS
CANTON, OHIO, U.S.A.

TRAVELS TO TOWNS WHERE THERMIT INSERT RAIL WELDING TERMINATED TRACK TROUBLES









BOSTON

Boston is the father city of Thermit Insert Rail Welding. The first Thermit Insert Welds, numbering over 500, were installed here between 1912-1913.

An inspection in December, 1919, of the Thermit Welds installed in Boston suburb of Forest Hills, showed that after *seven* years' service these welds are *absolutely as perfect as ever*, showing no sign of cupping or breaking.

Mr. Track Engineer, can you show us any examples of any other rail joints which can out-Methuselah this record and *show no signs of cupping or deterioration?*

If you are looking for a type of joint which will save you thousands of dollars in rail maintenance costs by prolonging rail life until the car wheels are running on their flanges be sure and pay these welds a visit. They will stand your most exacting inspection. These welds are on Walk Hill Street, Forest Hills, curiously enough near *Weld* Hill Street.

Send for Pamphlet No. 1232

METAL & THERMIT CORPORATION
120 Broadway
Chicago Pittsburgh San Francisco Toronto



"Next Stop, Boston!"

Thousands of

Arthur Power-Saving Recorders

are in successful use

WHY?

Because they save power, increase safety and decrease wear and tear on car equipment



Because they record *in minutes* how long the motorman runs his car with power on

"It talks the language of the motorman"

Other Reasons Why They Are Preferred:

1. Are easiest for the motorman to understand.
2. Following up the records costs the least.
3. Are most reliable — have no delicate parts to jar out of order.
4. Are fairest to the motorman under all conditions.
5. Are equally accurate at all line voltages.
6. One standard instrument fits all types of cars.
7. They provide valuable data for use of Inspection and Engineering Departments.
8. Absolutely no expense for winding up of clock mechanism — can be fitted with self-winding attachment.
9. Are most economical to purchase, install and maintain.
10. Are dust-proof and tamper-proof.
11. For the above reasons are most effective in results.

Once get the motorman to "start thinking" about how much he can run his car with power shut off and he soon learns to take advantage of every factor that will help his record — for instance:

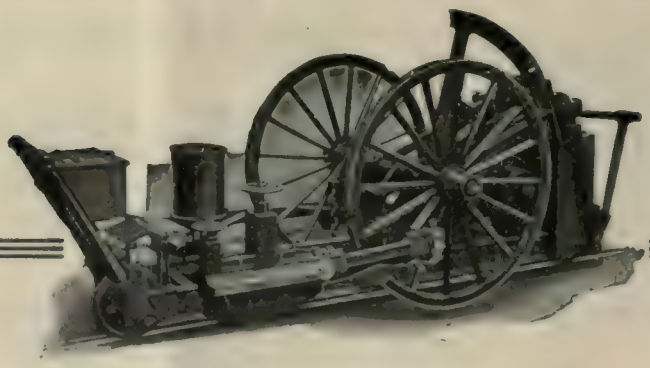
1. By coasting wherever possible.
2. By not crowding too close to the car ahead.
3. By not fanning the brakes.
4. By not carelessly allowing the brakes to drag.
5. By not applying power and brakes at the same time on down grades.
6. By not running ahead of time, or leaving terminal or end of line late.
7. By not keeping power on so long as to produce unnecessarily high and possibly dangerous speeds.

It is obvious that by running with power shut off as much as possible, the car is held under better control and can be more quickly stopped in an emergency. *Many accidents are thereby avoided.*

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It seems to be the feeling of some Electric Railways that in order to get successful Track grinding results a skilled mechanic is necessary for the operation of the Track Grinder.

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If you are planning to operate either a zone or flat fare system on the pay-leave plan, your motorman, instead of opening and closing the doors say at every other stop for departing passengers who choose the front end, will have to

Open and close the doors at *every* stop. Furthermore, if it is a zone system you are installing, the motorman will also have to issue zone checks to each passenger and, possibly, have to take care of a zone indicator.

These additions to the motorman's regular duties in running the car obviously make it desirable to lighten his labors through the elimination of existing hand-operated door and step mechanisms by National Pneumatic Door and Step Control so that the motorman can give more attention to his new duties *without slowing down his schedule.*

Whether you are installing National Pneumatic Door Engines alone or as a part of the famous Safety Combination of the Safety Car Devices Company, we urge that you also use the door shaft and step shaft devices of the National Pneumatic Company to secure the smoothest and most reliable operation possible with National Pneumatic Door Engines.

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Electric Railway Journal

which will appear March 20th.

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Tell them about your products and what they will do.

Wire us at our expense what space to hold for you. Tell us when to expect copy and cuts or send us data and we will prepare copy for you.

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Electric Railway Journal

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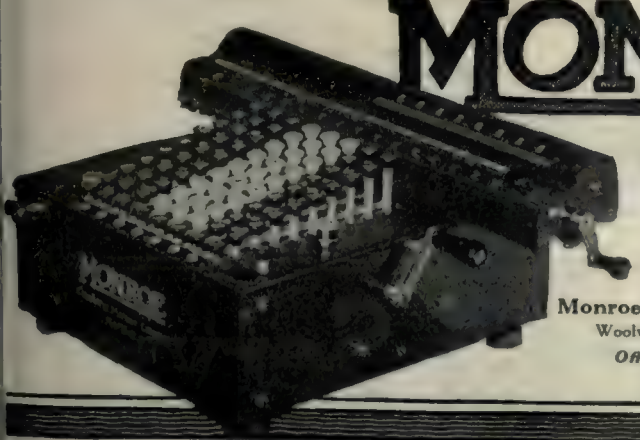
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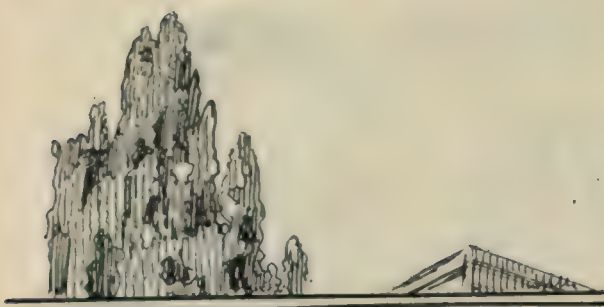
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E.R.J. 3-6-20



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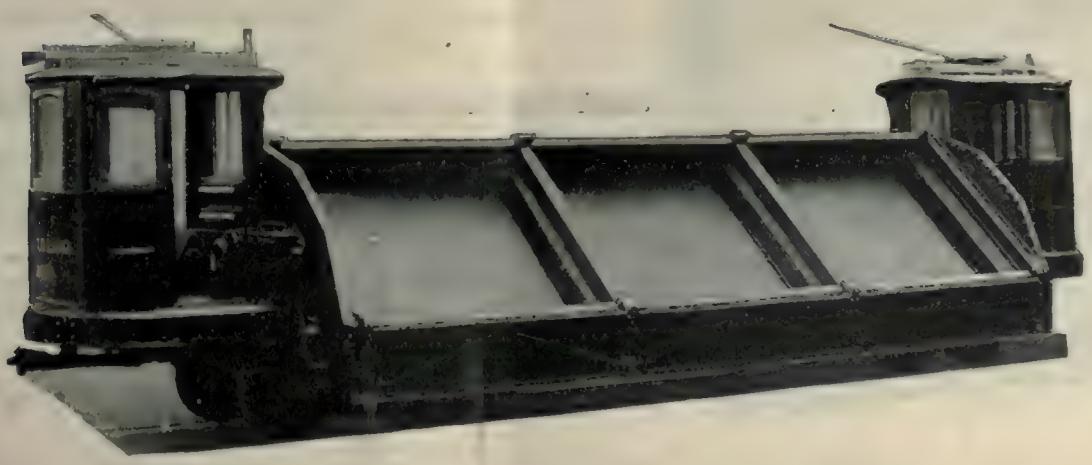
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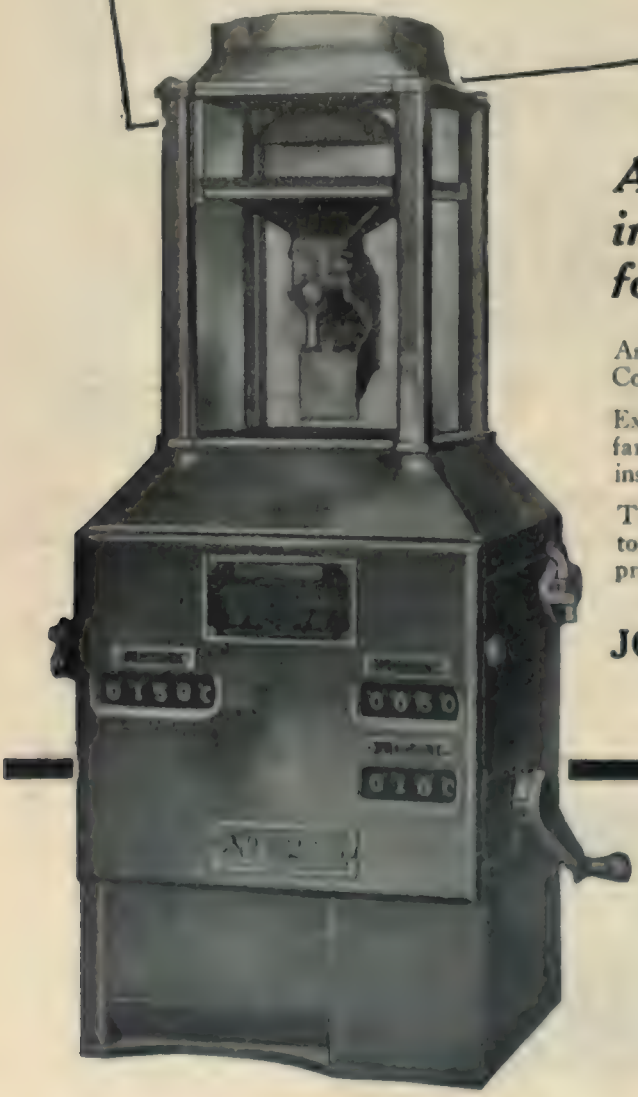
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have not only kept up with the reputation for superiority established in those early days but have maintained position a step or two ahead of it.

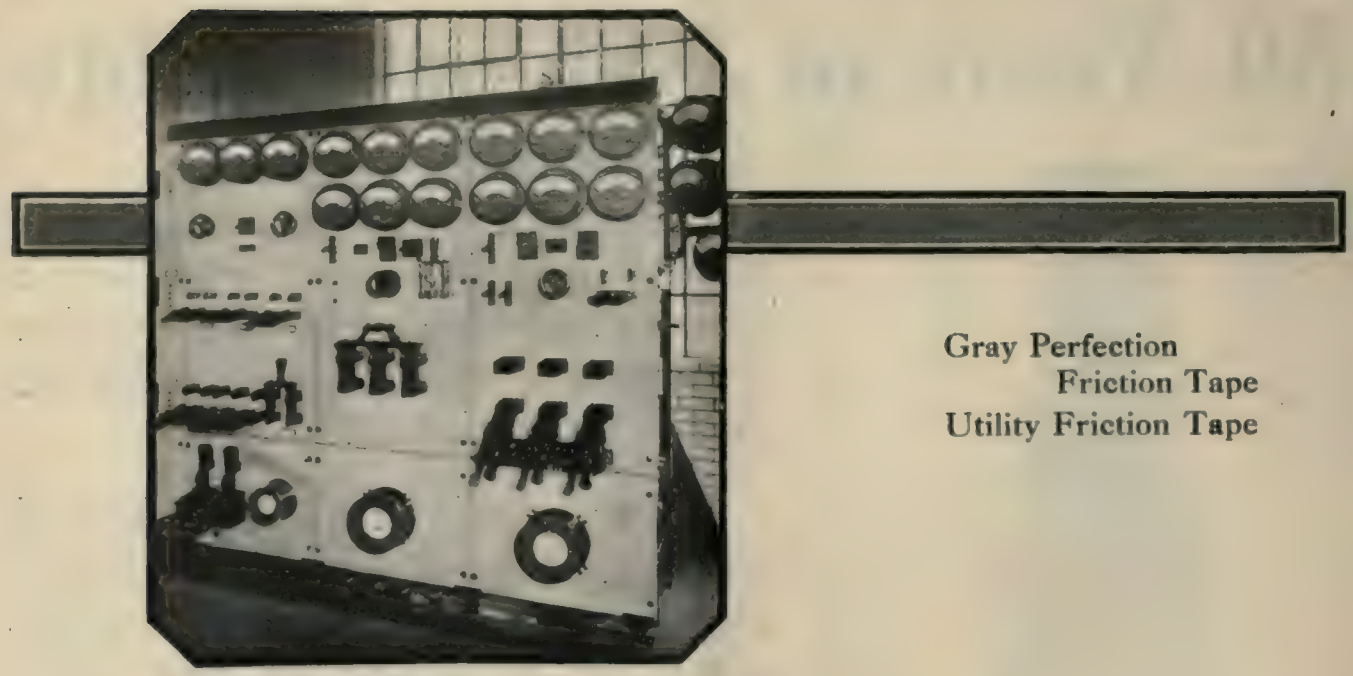
How successfully that endeavor has been maintained is best shown by the fact that still after 50 years Galena quality is standard with the great majority of the country's railway lines.

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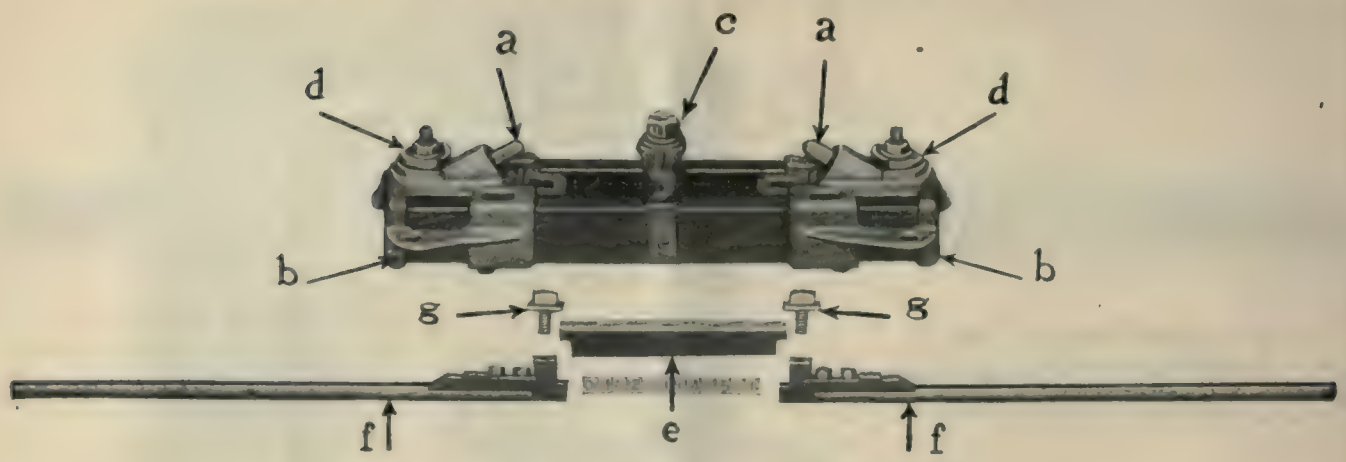
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Electric Railway Journal

Consolidation of STREET RAILWAY JOURNAL and ELECTRIC RAILWAY REVIEW

Volume 55 New York, Saturday, March 6, 1920 *Number* 10

Harbingers of the Day of Better Appreciation of Electric Railways

DURING the recent storm period the railway in a certain New England city was "stalled" by snow and ice. The situation far more than overtaxed the resources available to the management. Fortunately the citizens realized what transportation means to them, and they turned out *en masse*, armed with pick and shovel, and dug the railway out. They thus had a lot of fun and beneficial exercise, did the railway a good turn and saved themselves in the aggregate much time and money. May their tribe increase! In many localities where the patrons of the railway did not pitch in with pick and shovel they showed appreciation of the way in which the railways cleared a way for their own cars and, incidentally, in many cases, provided a runway for competing jitneys as well! Especially was this appreciation reflected in the newspapers, many of which were converted (at least for a time) from knockers to boosters.

It is only a question of time until good service will be appreciated. A little deprivation stimulates appreciation. To paraphrase an old saying, "You never miss the street cars till the snow banks high."

The Farmers Want to Help

APROPOS of several recent articles in this paper on the development of interurban electric railway freight transportation, our attention has been called to some press reports which indicate that the farmers in certain localities of the Middle West are keenly alive to some of the possibilities of freight transportation *a la* interurban. The inability of the steam railways to furnish cars for livestock transportation has resulted in serious loss to the farmers in those communities where livestock raising is an important industry. The transportation requirements of this industry are: first, transportation should be available when the stock is ready for the market; second, the stock, once loaded on the cars, should spend a minimum of time enroute to the destination market.

That the farmers are beginning to realize that the average interurban can meet these requirements in an admirable manner is evidenced by the efforts now being made by county and state agricultural organizations to secure this kind of transportation service from the electric railways. It is emphasized that where the farmers are able to ship their stock via traction, consignments can be delivered at the large depot stockyards, in the majority of cases two or three hours after they have been loaded. The secretary of the Farmers' Federation in one state is quoted as saying that if the interurbans were allowed to handle car-load shipments of livestock on a large scale, thousands of dollars would be saved each year to the farmers of that state on the weight shrinkage item alone.

It is true, of course, that freight cars, particularly those loaded with livestock, are not permitted on the streets in many cities. It is, however, a hopeful augury when powerful organizations outside of the railway industry begin to take an active interest in transportation matters and to demand rights for the transportation companies which they do not now possess.

The Electric Railway a Decade Hence

PROPHECY is risky unless the would-be prophet has accurate and ample knowledge in the field of his proposed prognostications. At the same time some kind of vision of the future is necessary in any line of endeavor if effort in that line is to be more than mere drudgery. Every wide-awake railway man is looking ahead, some farther than others, and the picture which enlightened imagination paints for him adds zest to his work, or takes the "pep" out of him as the picture is rosy or dun-colored.

A writer in a recent issue of a popular magazine forecasts some of the changes that the next ten years will bring in our habits of living and doing business, an important factor in which is the expected great development of air craft. He is very specific as to details and to insure a checking of his estimates at the proper time he suggests that his article be laid aside and his statements compared with the facts ten years hence. His advice suggests that a similar comparison of the electric railway situation in 1930 with the tendencies pointed out in the columns of this paper by many writers during the current year will be interesting, especially to those who have stayed by the business through the present trying period.

It would be extremely unwise to predict in detail what the traction business will be in 1930, but to the writer it appears certain that the industry will be here and that it will be prosperous. Traction securities will be securities in fact because the fares will be automatically adjusted to the cost of service, although there will be no speculative interest in them because the return will be limited. City cars will be much lighter, due to the use of special materials and to their average smaller size. Rails will still be in use, not only because the rails of 1920 will not have been worn out, but also because the necessity for them will still be realized. Among the convincing reasons for this necessity will have proved to be that electric power is increasingly cheaper with relation to other forms of power; that the series electric motor is the ideal motor equipment on account of its good starting, load-carrying and self-regulating qualities; that the maximum of passenger comfort can be

provided with a vehicle operated on a perfectly smooth runway, and that the railway car gives the greatest passenger-carrying capacity per mile of street per hour. While some of these advantages would also be inherent in the trackless trolley, that system will have been found adaptable in only a limited number of cases wherein the traffic would not support a rail line. The auto motor bus will be in large use as auxiliary to the electric railway, on extension of routes beyond zones profitable for the railway, on cross connecting lines and on routes where rails for one reason or another are not feasible.

The interurban business will be more highly developed than now, with lighter cars and more frequent service. A scheme of co-operation with the steam roads will have been worked out so that electric and steam lines will be given complementary rather than competitive service, each doing its share of the total business to which it is inherently best suited. Real progress will also have been made in electrification of steam trackage, following a logical program worked out on a co-operative basis to give the best over-all operating efficiency.

Merchants Know That They Need the Street Railway

THE electric railway manager who, upon looking out of his office window, sees one of his own trainmen driving to the carhouse in an automobile needs a bracer to maintain his optimism in the continued necessity for electric railway service. He will get that bracer the moment he begins to talk to the merchants about the relation of good business to good transportation. He may have supposed that they were quite indifferent to the decline of the service because of the increasing number of automobiles. They will soon make it clear to him with various degrees of forcefulness that they consider frequent electric railway service about 100 times as important as the possession of automobiles by everybody in the city. Mr. Merchant is a shrewd business man and he knows very well that if only five or six machines should park in front of his store—if they are allowed to park at all on a main street—automobile shopping becomes far more troublesome than street car shopping. The fact that the automobilist is more likely to carry off all or part of his purchases is not a sufficient set-off to the larger personal patronage that would come from a 50 cent increase in street railway service.

The anguished cries of downtown merchants which immediately follow the calling of a strike or of an increase in fare afford additional evidence of the worth that they attach to the cheapest and most capacious form of mass transportation. On such occasions they are quick to realize that their downtown corners are worth precious little more than a corner in the suburbs, if there is any material withdrawal of electric railway service or a discouraging increase in the cost thereof to the rider. At the same time, human selfishness is such that most business men do not realize their obligation to the electric railway until it is too late.

One would have to be an extreme optimist indeed to expect merchants to agree to any plan that would make them pay for the benefits that the electric railway brings them. Yet, it is not beyond hoping that they can be induced to *lend* at fair interest such amounts as the local railway needs to give that increased, lower-cost service which restores street railway travel to the volume of pre-automobile days and better. There are many arguments, constitutional and otherwise, against subsidizing a private corporation from public funds, but there are no legal obstacles against soliciting loans from those who would be most benefited by the continuance and improvement of electric railway service.

Pulverized Coal Burning Receives Impetus from Several Directions

THE burning of pulverized coal has for many years appealed to inventors as a possibly fruitful, and a certainly fascinating field for their endeavors. They realized that when coal reaches the furnace in dry, impalpable form it is in ideal condition for combustion, and that with suitable combustion space and careful attention to tube cleaning it can be burned with good furnace efficiency. The practical difficulties in the past have been largely in producing equipment for drying and pulverizing which would not too greatly complicate the fuel supply and too greatly increase equipment and operating costs. That these difficulties are being rapidly conquered is attested by an accumulating weight of evidence, a little of which will be adduced here.

Before we refer to specific cases, however, it may be worth while to point out that there is nothing radically new in the apparatus for preparing pulverized coal. A large part of it consists in conveyors, elevators, crushers, dryers, pulverizers, cyclone separators, exhaust fans, etc., all standard devices. Materials of many kinds have been dried and pulverized in the past, but under space and other limitations more liberal in most cases than are present in most electric power stations. Such an installation, however, is just another application of well-known processes which would have been made earlier if the past prices of good coal and fuel oil had not been so low. Present conditions render highly desirable the ability to burn low-grade coal, which can be done readily with the pulverizing system.

Readers of this paper will recall a description of an experiment made in 1917 by the Puget Sound Traction, Light & Power Company in pulverizing and burning culm. The outcome was the equipping of a number of boilers in one of its plants in Seattle for this purpose. An account of this installation and some facts regarding its operation are given this week. Here is a plant burning successfully what but a few years ago was considered mine waste. Again, within the next few months a large boiler room in one of the Philadelphia Rapid Transit Company's plants will also be outfitted to reclaim waste coal. This will be a peak-load proposition, the flexibility of the powdered coal "stoking" having appealed forcibly to the P. R. T. management.

The test run recently made at Milwaukee of five boilers fired with pulverized coal will give the further study of this method of firing in large power stations a real impetus. The test was personally observed by P. W. Thompson, a responsible engineer from what is generally spoken of as one of the most efficient stoker plants in the country, namely, the Detroit Edison Company. This observer might be considered to be biased, if prejudiced at all, in favor of stokers, yet he reaches the conclusions in his written discussion of the paper by John Anderson appearing elsewhere in this issue, that the boiler-room operation with pulverized coal as compared to stoker firing is much simpler; that from the standpoint of reliability the odds are in favor of pulverized coal, and that the elimination of many vari-

able conditions entering into stoker operation will result in higher efficiency for the pulverized fuel installation. These are certainly significant statements.

Mr. Anderson has substantiated his faith in the economies possible with pulverized coal burning based on two years' experience and experimenting, by announcing that the new Lakeside power plant of the Milwaukee system, the construction of which has been begun, will be originally laid out and equipped for using pulverized coal. The savings which he has demonstrated to be possible at the old remodeled Oneida Street plant, he thinks, can be realized and improved upon in the new plant by virtue of a design primarily for burning pulverized coal. The new plant will contain an initial installation of two 20,000-kw. generating units and eight 1,306-hp. boilers.

Both Mr. Anderson and Mr. Thompson point out that there are many improvements which can be made in the design of a new plant, particularly in the design of the furnaces, the location of drying and coal-pulverizing equipment, the method of coal handling, drying and pulverizing, the method of handling ash, the prevention of slag formation, etc. The working out of these improvements will undoubtedly add to the advantages of the system. There will also be found many weaknesses which will have to be eliminated as experience develops their existence. All these things indicate a vast amount of work yet to be done by designing engineers before the powdered coal system of firing can be pronounced a complete success. But the Milwaukee test will serve to arouse great interest not only in perfecting this system, but also in improving the general overall efficiency of stoker fired boilers. This augurs some good healthy competition, out of which the power plant industry is sure to derive benefit.

It is very fitting that the Engineering Association executive committee should have assigned the subject of burning pulverized fuel to the committee on power generation this year. The experiences of the companies mentioned above would alone be enough to make a good foundation for a report.

Some Valuation and Rate of Return Theories May Be Crystallized

ONE benefit to be derived from a commission decision which is detailed is that, upon appeal, more clear definitions of some theories may be obtained. Apparently our valuation and rate regulation practice is being formulated, a point at a time, by decision and rules as cases are appealed. And now another case, involving many interesting arguments and facts, goes to a court review. We refer to the appeals taken by the various Washington, D. C., railway companies from the decisions of the District Commission. These decisions have been mentioned before in these columns, but we print this week a more complete and analytical review by A. E. Knowlton. We speak of these several cases as one because they are so closely related and because several questions arise on account of the competing companies and the inter-company relations.

The District Commissioners, in both majority and minority opinions, have given detailed reasons for many of their findings, and it may be possible, from a court analysis of the case, to fix more definitely some of our ideas on valuation and the rate of return of competing companies operating with widely variant costs. Mr. Knowlton has called attention to some of the main features which must be considered on appeal. He has also mentioned what is certainly somewhat novel, namely, a company forced to appeal from a decision on principle, though the decision apparently allows a rate of return of over 14 per cent!

Why Jitneys Aren't Driven Out

THE electric railway manager, who long ceased to ride on his own street cars, is often sorely puzzled and hurt at the tepid reception which he gets from the public when he calls for the removal of the jitney. "Yes," says the public in effect, "We know that the jitney doesn't run on rainy days, that it doesn't pay its fair share of taxes, that it soaks us to the limit when the soaking is good and that our grandfathers gave you the sole right of carrying the common people; but the jitney is giving us some things in the way of speed and service that we are not getting from the electric cars and that is the reason we patronize them."

In a specific, though undoubtedly rather an extreme case, which came to attention recently, the railway is permitted to charge a 10-cent fare to an outlying community, while it costs 15 cents by jitney, yet the jitney gets the greater part of the business. If we look for the reason we find that it is because people do not have to wait more than two or three minutes for the six-passenger touring-car (for that's what it is) and they are delivered to destination in fifteen minutes. If they wanted to take a trolley car to the same locality the chances are that they would have to wait ten minutes and the ride would last thirty minutes at least, and in an old car at that. Can the people be blamed for preferring what is practically a taxicab service even if it costs 50 per cent more? What a lesson is there in this to those who believe that the public is really unwilling to pay a reasonable fare to get good service.

Another objection to the operation of jitneys, which their higher speed will not overcome, is the irresponsible character of the average jitney operator. A serious jitney accident will some time awaken a community for a brief interval to the fact that damages for personal injuries cannot be collected from the jitney owner, but the lesson is soon forgotten and the jitneys will be patronized again as freely as before. The average American is careless and is usually willing to take a chance when he can save time. But such a reckless point of view is inexcusable for those in charge of the interests of the community as a whole. If the public wants a system of mass transportation faster than that which can be supplied by the electric cars and auxiliary to it and is willing to pay a higher price for this kind of transportation, the authorities should see that it is supplied by a responsible organization, and surely there is no organization in any community so well trained in traffic methods as that of the local electric railway.

By this statement we do not mean that we are urging railway companies to engage in the bus business. But we do think, first, that modern operating methods and equipment will drive out a large part of the jitneys and, second, that insistence by the authorities on responsible operation and regular schedules will drive out most of those which remain. After all this has been done, if there are any bus routes left, the authorities could well approach the railway company to see if it would conduct their operation.



MULTIPLE-UNIT TRAIN OF CENTER-ENTRANCE MOTOR CARS

Brooklyn Adopts Surface Car Trains

Trains With Three Different Classes of Equipment Are Now in Use and a Total of 100 New Trail Cars and 208 Motor Cars Will Soon Be in Service

THE Brooklyn Rapid Transit and Brooklyn City Railroad Companies have been operating two-car trains on certain of their surface car lines for some time. The service has met with pronounced success and is popular with the traveling public, so that it has gained for itself a permanent place in street railway operation in Brooklyn.

Brooklyn's rush-hour service lends itself admirably to surface-train operation. It consists essentially of carrying large groups of people to and from New York across the Williamsburg and Brooklyn bridges, and picking up and distributing passengers through the business sections of Brooklyn. These business sections are located at the Brooklyn end of the bridges and extend back a distance of from a mile to 2 miles. These bridges and business sections form the necks of bottles through which it is necessary to operate as many cars as possible. The real problem in rush-hour transportation is then, how to increase the carrying capacity of the lines through these sections, and it appears that train operation affords the greatest prospect for success.

At present the loops which form the terminals at the New York end of the bridges are not adapted to receive trains, so that train operation has been confined to runs in Brooklyn which enter and pass through the business sections and no train service is operated across the bridges. This train service has proved of greatest value in relieving the congestion caused by carrying large numbers of people to the business districts.

CHARACTER OF SERVICE FURNISHED

The Flatbush Avenue line was the first one on which train operation was attempted. The train service on this line runs from the Flatbush Ave. depot to Borough Hall, Brooklyn, a distance of 6½ miles. The morning rush-hour service consists of picking up passengers in a district 1½ miles in length, which is suburban in character and stops average five or six per mile. These stops are of comparatively short duration, due to the small number of persons that board and alight at each point.

The second class of service is through a more closely populated residence section for a distance of about 3 miles. The stops in this section average from seven to nine per mile, and there are some transfer points with a correspondingly longer time for stops.

The remaining class of operation is through a business section of Brooklyn where the stops average from twelve to sixteen per mile and where headway between cars is so short, due to the operation of several lines over the same track, that there is very little operation beyond the series position of the controller. Frequent slowdowns for traffic also add somewhat to the congestion. The length of this business district is about 2 miles.

At present in Brooklyn the entire rush-hour service on any one particular line is not taken care of by trains alone, but single cars are intermingled with the trains. Train service is provided during the rush-hour period only. On the Flatbush Ave. line twenty-one trains are operated a total of eight hours per day and, in addition to this, forty single-car units are operated to make up the service. The shortest interval for this line is forty seconds, so a fair idea can be gained as to the density of the traffic. In starting either cars or trains, the interval is adjusted so as to give a definite number of cars in a given time interval regardless of whether single cars or trains are operated. Thus, where trains are operated on a three-minute interval, and it is necessary to replace a train by single units, two cars would be operated on a two-minute interval.

During the heavy traffic hours, the schedule speed for a two-car train is slightly slower than that for a

single car. This is due mainly to two conditions. First, trains made up of either two center-entrance motor cars or of a motor and a trailer have either center entrance doors or folding steps and doors, so that it is impossible for passengers to board or alight while the train is in motion. The single cars are not provided with folding steps and doors and are of the end-platform type so that many passengers board and alight before the car comes to a complete stop. This reduces the length of the stop and helps to speed up the service somewhat. The second fact referred to is the greater number of stops made by a two-car train as compared with a single car.

The advantages of train operation for certain classes of the Brooklyn service was recognized at the time when center-entrance cars were purchased in 1913. Accordingly, the multiple-unit equipments of these cars was arranged so that they could be adapted for train operation by adding automatic air and electric couplers and without relocating or reconnecting the equipment. The surface companies have 101 cars of this type, and additions necessary to permit of their use for train operation are now being carried out as rapidly as possible. Each car is 45 ft. 8 in. long and weighs 38,350 lb. A seating capacity of fifty-eight persons per car and a total capacity of 123 persons brings the carrying capacity for rush-hour service of a two-car train up to 246 passengers. Additional details of the equipment and construction of these cars were given in the ELECTRIC RAILWAY JOURNAL for March 30, 1912, June 22, 1912, and April 19, 1913.







TOP VIEW, MULTIPLE-UNIT TRAIN WITH PAY-AS-YOU-ENTER CARS. AT BOTTOM, INTERIOR OF CONVERTIBLE MOTOR CAR



TOP VIEW, MOTOR AND TRAILER TRAIN. AT BOTTOM, VIEW OF INTERIOR OF NEW TRAIL CAR

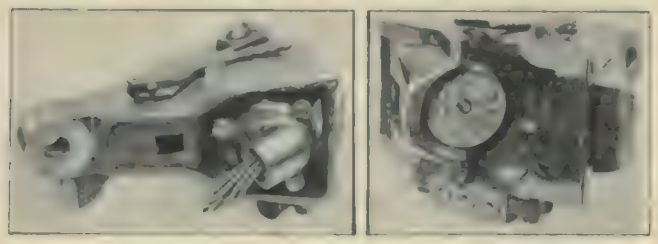
There are two different "make-ups" used for the Brooklyn train service. The first consists of the two center-entrance motor cars just referred to and the second a motor car with trailer. The motor cars used to haul the trailers are of the convertible type. They were purchased in 1905 and were described in the ELECTRIC RAILWAY JOURNAL of March 11, 1905. These cars weigh 25½ tons, seat forty-eight passengers and have four 40-hp. motors each. At the time they were purchased it was considered the best practice to buy large heavy cars with an excess of motor capacity. These cars have been in almost constant use since their purchase, in the most severe of Brooklyn's service often being operated twenty-four hours a day for long periods. The maintenance costs have been very low and from the operating man's point of view they have been most satisfactory.

When train operation was decided on for Brooklyn it was realized that the reserve capacity of these cars could be used to very good advantage in hauling trailers. An extended test was made to insure against overloading of the motors. One of the convertible motor cars was equipped for this test and a center-entrance motor car was stripped of its operating equipment to serve as a trailer during the test. Both cars were loaded to give a weight equal to that with standing load. This train was operated over various lines under conditions approximating as nearly as possible those of actual service. Results indicated that the motor equipment of these convertible cars was of capacity sufficient for the service and accordingly 100 trailer cars were ordered.

The trailer cars are of a low-floor center-entrance type. They are 45 ft. 6 in. long, 8 ft. 6 in. wide, 11 ft. 3 in. high from rail to roof and have 22-in. wheels. They are similar in appearance to the center-entrance motor cars used for train operation but have a monitor roof instead of the "turtle back" roof of the motor cars. They have a seating capacity of sixty-one and weigh 14 tons. Further information regarding their equipment was given in the ELECTRIC RAILWAY JOURNAL for June 8, 1918, page 1121.

ALL EQUIPMENT IS INTERCHANGEABLE

The equipment which it was necessary to add to the motor cars to permit of train operation was made uniform as far as possible. The couplers for all cars are Westinghouse type K-1-A automatic car, air and electric. Couplers were installed at both ends of the center-entrance motor cars of the "5,000 Series," but on one end only of the convertible motor cars and trailers. These latter units therefore operate in but one direction when made up for train operation. The couplers are unlocked manually by the pulling of a handle located on top of the coupler. After unlocking, the pulling apart of the cars returns the coupler mechanism to the locking position automatically. This is accomplished by a trigger with a projection to engage the coupler when in the unlocked position. The pulling apart resets the trigger. Should the handle be thrown to the unlocked position after the cars have separated, the mechanism



Side View End View
AUTOMATIC CAR, AIR AND ELECTRIC COUPLER

remains in this position until the operation of coupling is again carried out. The sliding together of the couplers then acts automatically on the trigger mechanism and returns the parts to the locking position. The coupling will then be made automatically with the couplers in either the locking or unlocking position.

NEW TYPE OF ELECTRIC COUPLER WAS ADOPTED

Accompanying illustrations show the type of coupler used. The electric portion is located in the central part of the coupler and has nineteen contacts with fourteen active circuits. There are fewer circuits than contacts because some of the contacts are connected in parallel to take care of large current values and to provide for reversal of ends of the multiple-unit cars without affecting operation. For the motor-trailer operation the circuits carried through the couplers are for lights, heaters, door operation, register operation, automatic signal circuits, bell and buzzer connections. For multiple-unit train operation, each car has its own power supply but connections are carried through the couplers for the control operation. A very ingenious arrangement of connections was worked out by the engineers of the railway so that no harm can result from coupling together of dissimilar equipments. Thus a convertible motor car which in regular service is operated with a trailer could be coupled to a multiple-unit motor car without complication. This arrangement is highly desirable for emergency conditions as it might be necessary to couple up to a crippled car or train in order to prevent a tie-up. Both ends of all cars are also arranged for coupling with a link or bar-type coupling, so that trains may be coupled mechanically to any car of the system.

The contacts in the electric portion of the couplers are arranged for butt contact at both back and front. A coil spring between the stationary and movable portions provides the necessary pressure. The back part of the movable contacts has a spiral thread and this gives a turning action to the contacts as they are compressed and insures good electrical contact. The wires are brought into the back ends of the electric portion through flexible conduit and are soldered into terminals attached to stationary studs. To facilitate the making of these connections and any repairs that may be necessary, this back portion can be removed as a unit without disturbing the contacts. The various parts of the electric head have rubber gaskets between them, and the front is also provided with a rubber gasket around the contacts to prevent water, snow or dirt from getting to the contacts when two cars are coupled together. A hardwood cover fitting tightly over the contacts protects them when they are not in use.

TWO AIR LINES ARE PROVIDED

The air connections for brake operation are carried through the coupler at the bottom. Three openings are provided; the center one being for straight air operation and the two outside ones being connected together for emergency application of the brakes. This arrangement provides for reversing the ends of the multiple-unit cars and also gives increased area for the emergency passage so as to insure rapid brake application. In addition to the couplers, Westinghouse type M-18-B brake valves and type D emergency valves were installed on all cars. This gives a straight air-brake equipment with an automatic emergency feature. The flexibility and simplicity of the straight air brake is thus retained for ordinary service operation and additional protection is afforded by the automatic application of the brakes in case of a "break-in-two" or bursting of a hose.

The principal features of this equipment with type D emergency valves are: straight-air operation for service stops; brake cylinder release locally through the emergency valve on each car; prompt service application and release operation; automatic maintenance of brake-cylinder leakage; uniform brake cylinder pressure independent of variations in piston travel or leakage; practically uniform compressor labor insured without the necessity of governor synchronizing system; automatic application of the brakes in case of ruptured piping, burst hose or parting of train; retarded release after an emergency application, as a penalty to discourage unnecessary use of this feature; need for but one size of emergency valve for any size of brake cylinder, and arrangement so the conductor can set the brakes in emergency by means of the conductor's valve.

The "H-B" life guards used on the center-entrance motor cars and those of the "4,100 series" and "4,300 series" interfered with the installation of the couplers, so that it was necessary to cut out the back of the life guards to provide clearance and also to do away with the apron for tripping. A new type of tripping mechanism was designed and installed. This extends out to the front end of the car and the front portion is constructed of ¾-in. wrought iron pipe. On the "4,100" and "4,300"

motors and trailers, where but one coupler is applied per car, no changes were made in the life guards at the other end of the car. On the center-entrance motor cars of the "5,000 Series" the previous type of coupler also interfered with the installation of the new type. This was removed and a slot was cut through the buffer immediately above the coupler to accommodate the coupler bar for use in case it is necessary to couple up to a car of another type which may be disabled. The installation of the couplers adds somewhat to the overall length of the cars, and in order that this additional length may not reduce the number of cars which can be stored in the space available in the different car houses, provision is made for swinging the coupler to one side and hooking it in position so that the cars can be laid up end to end. The couplers are the same for all types of car so that cars can be coupled up for use if necessary, but the present make-up of train service provides for the center-entrance motor cars to be made up together to make up a two-car train, both cars being motor cars, while the trailers are connected to motor cars of the "4,100" or "4,300 Series."

The electrical connections are carried from the couplers to a junction box located just back of the coupler through flexible conduit and the three air connections which are necessary in the coupler are made with flexible hose.

Changes Made in Electrical Equipment

In order to provide for train operation of cars of the "4,100" and "4,300 Series" a Westinghouse No. 806-C line switch has been installed and the tripping mechanism has been removed from the circuit breakers located on the front platforms of the cars so that these act only as switches to open the circuit by hand. The line switches take care of overload conditions. Provision for operating the line switches is made at the bottom of the K-28-B controllers, which are used on these cars. The main circuit as rearranged is from the trolley through the fuses and then to the line switch. From this, connections are made to the two circuit breakers on the front of each platform, and from these to the controllers.

The signal system used consists of a motorman's light which indicates when all doors of both the operating car and the trailer are closed. For passing signals from conductor to conductor and from car to car and to the motorman a buzzer system is installed.

Advantage is taken of the fact that these cars must be put through the shops for the addition of this new equipment to make other changes and submit them to a general overhauling, and painting. On the "4,100" and "4,300 Series" cars the inside bulkhead has been removed at both ends, and new doors and folding steps have been installed for entrance and exit. In this reconstruction, provision is made for the use of the electrically operated cash register, and push buttons are installed for the use of the conductor in operating the registers.

A second class of multiple-unit train is also in operation on the Brooklyn lines. There is but one of these units at present and it consists of two cars of the "3,300 Series," with end platforms, which have been altered by the addition of new safety doors and folding steps. Multiple-unit operation of the control has been accomplished by the addition of a Westinghouse PK head to one controller of each car. These cars are slightly over 37 ft. in length, seat thirty-five passengers and each have two 60-hp. motors.

Daylight Saving Again Discussed by A. I. E. E.

Lighting Expert, on Basis of Investigation, Concludes That Daylight Saving on the Whole Costs More Than It Saves—Others Disagree on This Point

PRESTON S. MILLER, general manager Electrical Testing Laboratories, New York City, presented a paper on daylight saving at the recent midwinter convention of the American Institute of Electrical Engineers, stating that the paper was the result of an impartial investigation by himself of the various factors relating to daylight saving. He found that the total output of certain central stations of one gas company was reduced by about 3 per cent during the seven summer months. For lighting alone the reduction was 8 per cent. If these fragmentary data were applied to the whole country, the estimated annual saving is $19,250,000 in expenditure for artificial light and nearly 500,000 tons per annum in coal consumption.

He named the several advantages of daylight saving as outdoor recreation, saving in expenditure for artificial light and saving of fuel. The disadvantages are experienced principally by farmers, dairymen, truck gardeners and miners. He concluded that economic losses probably far outweigh the gains.

In analyzing the present allocation of hours for work, sleep and play, Mr. Miller argued that these have been evolved through long experience and are the result not of the periods of darkness and light but the combined results of the natural distribution of darkness and light and of temperature, throughout the twenty-four hours of the day. He claimed that our sleeping habits are a compromise between the natural desire to sleep in the dark and the natural desire to sleep during the cooler part of the day, and that any arbitrary disarrangement of this schedule is wrong physiologically. He presented a chart upon which were plotted the distribution of light and temperature throughout typical days in June, September and December.

Mr. Miller contended that the advancement of clocks had served the interests of only one part of the population and had proved very disadvantageous to another part, which appears to be a large part of the total population.

In the subsequent discussion, R. S. Hale, of Boston, suggested a more accurate method of comparing central-station output during daylight saving and during normal times, stating that the output should be compared on sun-time basis and not on clock-time basis. Others, in discussing the paper, brought out the point that the only farmers seriously affected were those near large centers. The effect on central stations along the New Jersey Coast supplying summer resorts was said to be much more aggravated than the average of the country, as in some instances a 20 per cent reduction was noticed. This is particularly disadvantageous because these companies operate chiefly in summer and a 20 per cent reduction for a few months means practically a 20 per cent reduction for the entire yearly output of the power station.

Although Mr. Miller brought into the discussion of daylight saving some new elements, the members of the meeting were not entirely convinced that the repeal of the daylight-saving law will, in general, prove to be beneficial to the country.

Comparison of Steam Power-Plant Performance

At A. I. E. E. Meeting Engineer of Interborough Rapid Transit Company Pleads for Uniformity in Statistics to Permit More Accurate Analysis

AT THE recent New York convention of the American Institute of Electrical Engineers, W. S. Gorsuch, engineer of economics Interborough Rapid Transit Company, New York City, presented a plan which he claims will make possible more accurate comparison of steam power-plant performance. This is discussed largely on the basis of attempts to compare operating statistics of steam power plants as published today by various state and governmental bodies. Complaint is made that there is no present uniformity in reporting the output of a power plant, the gross output being used in some cases and the net output in others. Load-factor figures as given are often misleading because they are computed upon different bases.

It is not proposed to make an analysis of the thermal characteristics or cost of generation in power plants, but rather to adopt as a criterion for comparing power plants the commercial efficiency, that is, the total cost per kilowatt-hour sent out from the alternating-current power station bus, which is the ultimate test of design and operation. To render such a comparison accurate would require a uniform system of accounting and many other impracticable uniform practices. For that reason Mr. Gorsuch has evolved a means of comparison which is limited to the cost of coal, the largest single item in the cost of generation in coal fuel power stations.

DATA NEEDED TO PERMIT ACCURATE COMPARISON OF POWER PLANT PERFORMANCE

	Plant A	Plant B
I. *Coal Characteristics of the Plant*		
1. Average B.t.u. supplied to plant per kw-hr. net output	22,400	25,600
2. Thermal efficiency of plant in per cent	15.24	13.34
3. Average B.t.u. per dollar, coal as received (moist basis)	5,226,666	5,734,400
4. Coal factor, or pounds of coal per kw-hr. net output (moist basis)	1.60	2.00
5. Average B.t.u. per pound coal, as received (moist basis)	14,000	12,800
6. Cost of coal per ton (2,240 lb.) delivered alongside plant	6.00	5.00
7. Kind of coal	Bituminous	Bituminous
8. Cost of coal in cents per kw-hr. net output	0.428	0.446
II. *Load Characteristics of the Plant*		
9. Average daily factor of load. } Interval of	50	54
10. Maximum load for one year. } maximum load	90,000	80,000
11. Yearly load factor of load } one hour	40	38
12. Kw-hr. net output for the year—(kw.hr. sent out from the a-c. bus)	315,460,000	217,248,000
13. Installed rated capacity, that is, the aggregate maximum continuous rating of the generators in kw	125,000	100,000
14. Average kw-hr. net output per kw. installed rated capacity	2.525	2,173

The fourteen items given in Table I are those desired by Mr. Gorsuch in order to get a reasonably accurate comparison between two power plants. Figures are given for two power plants to show the application of the system to specific cases. In this comparison chief dependence is based upon an accurate knowledge of the quality of the coal used and a uniform method of analyzing the load characteristics of the plant.

With the present method of recording power-plant statistics, item 4 in the table would be given, but items 1, 2, 3 and 5 would not. In this case it would be impossible to tell whether or not any part of the difference in the coal factor was due to the quality of coal. If the relative merits of the two plants were judged from the coal factors alone, a comparison would be misleading for the reason that while the coal factor for plant B is 25 per cent higher than for plant A, the B.t.u. supplied per kilowatt-hour net output is only 14 per cent higher.

In the subsequent discussion, R. S. Hale of Boston suggested that load factor be taken for eight hours per day or ten hours per day instead of twenty-four. In case a monthly load factor of 80 per cent is given, does the plant run day and night or does it run in day time only? This is an important factor to include in the data.

Philip Torchio, of New York, chairman of the power station committee of the Institute, in contributing to the discussion by letter, stated that the object in gathering statistics of this sort is for state and government reports and it is hoped that government agencies will standardize questionnaires. A comparison of gross thermal efficiency of steam plants is not contemplated, in fact it cannot be undertaken by the government, but much useful information could be obtained if state and governmental bodies would adopt a uniform plan for a questionnaire upon some such basis as suggested.

Edward J. Cheney, engineering division Public Service Commission, New York, rose to say how difficult it is to fit various requirements in the questionnaires sent out by governmental bodies. This particular suggestion of Mr. Gorsuch might be satisfactory for power men, but how about the meter men who would want statistics on cost of reading, setting, etc., and the outside distribution man on his costs, etc.?

In answer to this, it was argued that if the governmental bodies will merely shape their questionnaires so that the information is useful for comparison that is all that is required. No great increase of data obtained is wanted.

Rail Failure Statistics

A REPORT on rail failure statistics for 1918 has recently been published by the American Railway Engineering Association. This report covers rail failures on steam railroads throughout the United States and Canada.

As a comparison between open-hearth and bessemer steel rails, failures per 100 track-miles are recorded. For rails rolled during the years 1913, 1914, 1915 and 1916, giving respectively five, four, three and two years of service, the report shows that bessemer rails had respectively 19, 134, 86 and 49 per cent more failures. As bessemer rails were in general in less severe service than open-hearth rails, the actual difference in the same service would undoubtedly have been greater.

The average failures per 100 track-miles of the rollings for the years from 1908 to 1918 inclusive covering both bessemer and open-hearth rails are tabulated. The 1908 to 1913 rollings show successively decreased numbers of failures compared on a basis of five years of service, and the 1914 rolling shows a further decrease when compared on a basis of four years of service. The more recent rollings, according to the report, are not starting out so well.

According to a statement in the *Engineer*, London, electrification work in Switzerland is advancing steadily. It is hoped that the Gothard line between, approximately, Erstfeld and Faido, may be in electrical operation about July 1, 1920. The work on this line has been delayed through difficulty in installing the electrical equipment. Insulators have been particularly difficult to obtain.

Washington, D. C., Valuations Reviewed

Orders of the District Commission Show Thorough Arguments on Practically All Points Considered — Some New Stands Taken by the Commission

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THE District of Columbia Public Utilities Commission issued, last fall, two orders with reference to the two railway systems in the District. These were referred to by the ELECTRIC RAILWAY JOURNAL in the issue of Sept. 13, 1919, showing the valuations fixed, and again in the issue of Oct. 11, 1919, showing the increased rates of fare authorized. An appeal for a higher fare was filed by one company, as mentioned in the issue of Jan. 10, 1920, and all valuation figures were appealed by both companies as mentioned in the issue of Jan. 17, 1920. The orders in these cases are now available for analysis in Public Utility Reports, 1919F.

These decisions are notable in that, considered together, they present most of the questions that arise in connection with current rate cases, and one is especially significant because of a practically unprecedented action with reference to competing traction companies. Both present majority and minority opinions with unusually good expositions of the diametrically opposed conclusions.

One case was that in which the Washington Railway & Electric Company petitioned for an increase of fare for itself and its subsidiaries. A previous ruling of the commission authorizing a charge for inter-company transfers at once involved the other principal system, the Capital Traction Company, and this reason, as well as that a broad discussion of the desirability of some form of measured service might be had, led the commission to make the Capital Traction Company a party to the proceeding. The initial fare asked for was 7 cents, and other items were the abolition of transfers between constituent companies and the abandonment of certain through routes. The chief point in favor of a zone system, in the opinion of the commission, was that it would serve to reduce the great disparity in net operating revenues of these two principal systems. Congress had, however, established and observed a certain civic practice relative to the development of the numerous suburban districts of Washington, and the commission deemed it inadvisable to upset this practice. As will be seen shortly, this feature leads to a decision of considerable moment and one practically unprecedented —that the fares of competing systems should be equal regardless of the resulting net rates of return to the two companies.

The commission discarded the suggestion that the Washington Railway & Electric Company derive its needed increase in revenue by increasing its existing rates for electric light and power, with the remark that such a procedure was "not only inequitable and unjust, but illegal." Commissioner Gardiner, in his dissenting opinion, supplies the items numbered 5 to 12 inclusive, in the accompanying table, and argues from these that the approving order is as susceptible to injunction as an order raising the light and power rates of the Washington Railway & Electric Company rather than its traction rates in order to provide a fair return on traction capital. Congress had in 1900 permitted the Washington Railway & Electric Company to acquire the stock of the Potomac Electric Power Company as well as of its present railway subsidiaries, and Commissioner Gardiner construes the intention of Congress to have been that "the system as a whole, operated as one, would be a benefit to the riding public as a whole." In his opinion, this act and intention of Congress as readily justifies a raise in power rates to provide a fair return on traction capital as it does the application of the instant order which in effect raises fares on the now profitable city lines to compensate for losses on suburban lines.

Part of the disparity in net incomes of the two companies is attributed to the long-standing tax of 4 per cent on gross income and the commission announces its intention of advocating before Congress the substitution of a sliding scale tax on net income.

	Washington Railway and Electric Company System	Capital Traction Company System
1. Trackage in Dist. of Columbia (miles)	135	64
2. Cars per day	350	250
3. Passengers per day	230,000	230,000
4. Suburban lines (miles)	10	2
5. Fair value as of June 30, 1919	$16,106,368.14	$14,270,495.51
6. 6 per cent return should be	$978,514.88	$856,229.73
7. Taxes (4 per cent tax on gross income) 1918	$138,000.00	.....
8. Net return should be	$1,116,514.88	.....
9. Actual net earnings (7 mos. 1918)	$65,000.00	$780,000.00
10. Difference from 6 per cent return (7 mos. 1918)	—$586,000.30	+$280,532.64
11. Existing rate of return, per cent	0.588	9.36
12. Estimated rate on approved fares, per cent	6%	14.22
13. Wages to car crews (7 mos. 1918)	$750,000.00	$600,000.00
14. Other operating expenses and taxes	$1,815,000.00	$1,110,000.00
15. Cost per car mile	$0.3625	$0.3185
16. Cost per passenger carried	$0.052346	$0.035146

There is tabulated below a list of comparative physical and financial items, some of the latter reflecting the marked difference in physical character of the two systems and the areas they serve and also the effect of the commission's equal raise in rates for the two systems.

Many important questions arose in connection with the other case, that of the Capital Traction Company, and it is of interest to examine the manner in which these questions were disposed of. The company's experts and the commission's accounting expert followed two widely different methods of determining "historical cost" and "both, in the opinion of the commission, have merit and must be very carefully considered in the determination of" the total valuation. The company claimed values based on the actual cost of the property to the present owner. With reference to this method, the commission says:

"Much of the investment may be represented by expenditures of an abnormal nature or which relate to other than physical property; such as increased book value resulting from the transfer of property, discount on stocks and bonds, cost of financing, promoters' fees,

and additions to capital account by reason of the revaluation of the property. Probably the greatest of these consists of increasing the investment account upon the transfer of property, in order to bury in plant account the bonus, which is paid generally in securities, to acquire operating control." The commission outlines the procedure of its accounting experts in arriving at a total "historical cost" as follows:

"Under the second method, i.e., the ascertainment of the actual cost of the existing units of a property used and useful for the public at the date of valuation, an entirely different course of procedure from that followed in the first method becomes necessary. A thorough and detailed analysis of the plant account must now be made in order to ascertain just what items are included in the investment account. The various units of property must then be classified or grouped and their cost and date of installation determined . . . the more serious and exacting duty of the investigator" is then "to determine the amount of property that has gone out of existence, but is still included in the plant account. This disappearance of property is due to various causes, such as losses by fire, abandonment, sale, changes in the art, experimentation, and obsolescence, such losses not being properly adjusted in the books."

The commission excluded from the total amount stated to be the historical cost of the property early losses incurred by one of the constituent companies for the reason "that such losses are not a part of the amount of money expended" but "constitute an intangible element to be considered in finding fair value." An item of $8,000 for cable patents was disallowed, the patents having expired. "Such items as patents under any circumstances should be taken care of by earnings, and should not be allowed to remain in the plant account." On the other hand, the cost of right of way for a line later abandoned and the land dedicated to the District of Columbia for park purposes was allowed as a development loss. Profits received from the sale of various parcels of land were, however, applied to reduce the total of development loss allowances. Another allowance in connection with development losses was one of about $84,000 to cover the value of "cars abandoned as the result of an order of the Interstate Commerce Commission forbidding the use of single-truck cars." Perhaps the most interesting development loss allowance, though, is one of about $450,000, representing the loss incurred by reason of the fire that destroyed the old cable power station, not fully covered by insurance. The company had either to rebuild for cable or construct for electricity, then under contemplation, and the latter plan was adopted. The commission made the allowance on the company's contention that, even if the fire had not occurred, underground electric motive power would have been adopted soon and the abandonment of the cable plant would have followed with probably greater loss.

The company also asked to have included as development loss one item of $50,000 as estimated loss in connection with rebuilding a car barn and office building and another of $13,421.79, the difference between original cost and amount received from sale of an engine-generator set. These "items . . . cannot, in the opinion of the commission, be considered in the light of development losses. Upon any accounting theory losses brought about by the reconstruction of buildings or sale of superseded equipment in the usual course of business should be taken care of by charges to depreciation."

Taking up the details of the appraisal, one finds a very instructive tabulation (according to Interstate Commerce Commission classifications) of reproduction cost, residual value, depreciable value, annual depreciation per cent, etc. That they may be available for purposes of comparison, certain of the percentage items are tabulated below, Chief Engineer Pillsbury defining "per cent remaining" as the ratio of the "remaining life" to the sum of "age" and "remaining life."

The commission made an allowance of $108,000 as working capital, this amount being arrived at by taking one-twelfth of the annual operating expenses and real property taxes. In approaching the matter of "established business" as an element of fair value, the commission ruled that the appraised value of some $5,000,000 for a part of the company's property for which it paid over $10,000,000 called for treating the $5,000,000 difference, not as associated with cost of reproduction, but rather "with that other element of fair value," namely, actual or historical cost. In claiming that the commission must allow as part of the fair value of the entire purchase price of this property, the company cites the U. S. Supreme Court decision in Willcox vs. Consoidated Gas Company, 212 U. S. 19,-

Inventory Division	Per cent Remaining	Annual Depreciation Per cent	Ratio of Reproduction Cost Less Depreciation to Reproduction Cost
A. Land	100 00	0	100 00
A1 Removal of obstructions	100 00	0	100 00
B. Way (track and roadway)	76 71	3 41	77 42
C. Structures (buildings)	84 93	1 54	86 18
D. Power plant and substation equipment	77 18	4 17	78 84
E. Transmission and distribution system	70 51	3 23	78 52
F. Rolling stock	74 84	4 22	76 08
G. General equipment office, shop, store, stable, garage etc	69 52	8 87	72 12
H. General costs legal, organization, engineering, superintendence, insurance, taxes, etc	90 12	1 45	90 07
Materials and supplies	100 00	0	100 00
Working capital	100 00	0	100 00
On total physical property devoted to railway service in the District of Columbia	81 82	*2 67	82.51

* This applies to depreciable cost, not to total cost of reproduction

and further contends that the "purchase was specifically authorized by Congress; that it had been acquiesced in by the public for many years; that the stock issued in pursuance thereof had been largely traded on, on the faith of this transaction; and that the condition created at that time was a fixed condition not to be changed or made the subject of any sort of disturbing analysis." But the commission finds little parallel between the Capital Traction and Consolidated Gas cases, analyzes the financial history of the purchased road, and, without specifying any amounts, says:

"This transaction has neither been ignored as an evidence of value by the Commission, nor has the amount been completely disallowed, the fullest consideration having been given to the intangible elements of value represented in this amount."

It is thus seen that in this case, which presents an unusually varied group of problems, the regulatory body has found grounds for deviating from precedents established in cases which are to some extent parallels and it is certain to be a matter of much interest to see the attitude the District Supreme Court will take as to these points when the appeal is ruled upon. In passing, it is not often the case that a utility, whose rates have in effect been advanced to a resultant 14 per cent return, finds that the circumstances necessitate or even warrant an appeal from the decision.

Sidelights on Some Fare Situations

On Recent Visits to Toledo, Cleveland, Buffalo, Rochester, Syracuse and Utica a Number of Significant Items Were Noted

BY "SPECTATOR"

IN THE COURSE of his regular duties, the "Spectator" happened recently to drop in on electric railway friends at a number of cities along the line of the New York Central Railroad, in which, as a group, the fare situation presents itself in several different aspects. In fact, if they had been selected for the purpose, no better choice of cities could have been made to illustrate the difficulties against which railway operators are now contending. While the situations in all of these cities have been depicted from week to week in the news columns of this paper, a few sidelights such as would be noted by a sympathetic visitor may be of interest.

ALL QUIET ON THE SURFACE AT TOLEDO

After reading of the sensational street railway "stunts" which had been "pulled off" in Toledo, Ohio, within recent months, the "Spectator" was agreeably surprised to find the car service normal and popular. In spite of the obstacles in the way of working out a satisfactory franchise, there was evidence of friendly good feeling all around on the personal side, due no doubt to the individual popularity of Frank R. Coates, president of the Toledo Railways & Light Company, and his associates, A. C. Van Driesen, J. M. Enright, A. Swartz, and others. It was evident also that the public appreciates the fact that Henry L. Doherty ardently desires to give the city good service. The deadlock which had developed regarding the financial and operating conditions of the hoped-for franchise seems almost inexplicable to a casual observer.

One thing stands out very clearly in Toledo, namely, that the city is becoming very much ashamed of the reputation which it is getting throughout the country, although locally it is thought that this reputation is not deserved. A movement is now on foot to stimulate "boosting" of the city to offset the popular practice of "knocking" which patriotic citizens say has infected the city itself. Good friends of Toledo feel, however, that by hampering its electric railway development, the city has set itself back many years in its growth, and the pity of it all is that if given a reasonable opportunity the management of the railway would take pride in giving as nearly ideal service as is enjoyed anywhere.

As for the company itself a wonderfully fine spirit pervades all departments. Mr. Doherty's strong and helpful personality pervades the whole institution, and the spirit of solidarity is conspicious. The fact that the company supplies a quadrilateral service—transportation, light and power, heat and gas—makes it very broad in its interests. A few months ago the administration offices were consolidated in an attractive building, especially fitted to their needs, and an auditorium seating 500 or more for the use of the joint company sections of the four national societies representing the four departments of the company was provided. The effect of this move is already evident in the greater spirit of company unity and loyalty. At Toledo the welfare work of the company is handled by the company section, which has a much broader function and greater responsibility than most organizations of its class. The section has nearly 1,500 members and it is the expectation of the local officers that shortly it will also include the few hundred employees still outside the fold. A man of proved ability in promoting friendly relations with employees has been engaged to give his entire time to the personal side of the company section work, and another man, with suitable clerical assistants, will look after the office routine. The "Spectator" will be greatly surprised if within the current year "Rail-Light," as the company is locally known, does not make a notable improvement in its already remarkably successful work for employees.

FAIR PLAY FOR THE INVESTOR AT CLEVELAND

As the home of the Tayler franchise, Cleveland is of all cities the one most frequently referred to in connection with fare cases, although Philadelphia is coming to be a close second. In spite of the publicity forced upon it, the Cleveland Railway is much misunderstood because the name Cleveland and the 3-cent fare are indissolubly associated in the public mind. By "pinching" the investors, it has been possible to make ends meet on the present 5-cent fare in Cleveland, because traffic conditions have been unusually favorable lately due to the prosperity of the city. Men in responsible circles now appear to favor an increase in the return to investors above the original 6 per cent prescribed. The people must now decide the matter, and it is to be hoped that they will realize the importance to themselves of maintaining the attractiveness of the property as an investment.

As has been the case for many years a fine democratic spirit permeates the organization, typified by the unconventionality and friendliness of President John J. Stanley. Colonel J. H. Alexander is back "on the job," full of vigor and enthusiasm from his war experience, already making his influence felt strongly in co-operating with Mr. Stanley, General Manager George L. Radcliffe, and their associates, in solving some very pressing problems. Among these problems the "Spectator" found that one of the most serious is the reduction of accident costs. For many years Cleveland has been a great place for automobilists, who have seriously hampered rail transportation. Of course, this is a worrisome proposition in all cities, but somehow Cleveland seems to have been particularly hard hit of late. Colonel Alexander has organized his department in such a way as to co-operate with the traffic, engineering and other departments through especially qualified assistants, and is planning to get better control of the accident situation. The "Spectator" predicts that the results of this arrangement will be good.

The impression of the Cleveland situation which one carries away is one of hope that the citizens of the city will blaze a trail by acquiescing cheerfully to an increase

in the rate of return to the stockholders. If by so doing they show appreciation of their fine local transportation system, they will encourage the management to carry out desired and needed improvements. They will also help in getting justice for investors elsewhere.

MUTATIONS IN PROGRESS AT BUFFALO

The fare situation in Buffalo is unique in that, while the company has permission to charge a 7-cent fare or to sell four tickets for a quarter, the fare is still held at the old 5-cent level. In taking over the control of the property, the bondholders apparently feel that the time is not propitious for taking advantage of permission to raise the fare.

After long and somewhat bitter controversy between the railway company and the city, the jurisdiction of the Public Service Commission over the local fare situation was clearly established, but undoubtedly this has left a considerable resentment in the city among those who lack confidence in the justice of the awards of the State court. While the present management has not yet fully stated its policy in regard to the matter of fares, one can easily surmise that the policy of conciliation with respect to the fare increase is to be adopted. The "Spectator" has noted elsewhere that when there is a change of management, the public is inclined to give the newcomers a chance to show what they can do, and presumably this rule will hold in Buffalo. This spirit of toleration would obviously be intensified if the new management said in effect that it desired to go into all possible details of operating economies to see if any less than the permitted maximum increase would meet its needs. In any event, the Buffalo situation will prove very interesting from the railway news standpoint for some time to come.

ROCHESTER IS STOLID ON THE FARE QUESTION

From the standpoint of reasonable fare, Rochester is one of the most discouraging cities in the country. The unfortunate "Quinby" decision of the Supreme Court of New York State hit Rochester especially hard. When the "Spectator" called, he found that Vice-President J. F. Hamilton and most of the heads of departments were in New York City improvising an operating organization for the Fourth Avenue-Madison Avenue line, which was taken over Feb. 1 by the financial interests behind the New York State Railways. However, it was possible to size up the local situation about as follows: In many ways public sentiment in Rochester favors a reasonable return to its transportation utility investors, and the company has the backing of the leading business interests. On the other hand, the city council is unwilling to risk popular disapproval of a decision to permit a fare increase. Mr. Hamilton and his associates apparently have the confidence of the people, but somehow this confidence does not take the desired concrete form as yet. The company has under way an advertising campaign which ought to bear fruit. Numerous small "cards" averaging, say, a single column wide and 2 in. high, have been carried in the local papers, each impressing one or more facts regarding the fare situation. These are signed by Mr. Hamilton, and are very frank in stressing the deplorable financial condition of the property.

In Syracuse the situation is much more favorable than that just described as obtaining in nearby Rochester. The people in Syracuse are reasonable, and acquiesced with good grace in the 6-cent fare proposition. However, this fare is far from meeting the needs of the company and the situation in the city is really deplorable. Money is not available for necessary maintenance, to say nothing of service improvement. The city lines are blessed with excellent shops, however, so that it is possible to maintain the cars with reasonable expenditure.

The conviction is growing in Syracuse that the city and the local lines operated by the New York State Railways must get together on some kind of a service-at-cost proposition. It is the hope of the management that when the city has really become convinced that, even with its reasonable attitude toward the company, some radically different means must be provided if good service is to be maintained, results will follow promptly.

A number of very fine interurban lines center at Syracuse, and in their case the outlook is better. The interurban mileage rate in the vicinity is as high as competition with the steam railroads will permit. All kinds of operating economies have been introduced, and one of the important companies is now contemplating a complete equipment of automatic substations along its main line. This company is also installing meters on its cars to induce energy saving. Another finds that by the use of reasonably light cars of large capacity a profitable business can be carried on.

As Utica is operated under the same managership as Syracuse, and as the fare situation in the two cities is the same, what has been said with regard to Syracuse may be said to apply here. The city is much smaller than Syracuse, but as the two cities show the same spirit in connection with the fare increase, presumably they would follow the same course if a service-at-cost franchise could be worked out.

Syracuse and Utica are connected by the electrified West Shore line, or Oneida line, on which is the Manlius Center automatic substation, mentioned several times in this paper. This station has given a very good account of itself, and while it has come in for criticism occasionally, in some cases this criticism was not properly directed against the automatic equipment. The station shows an actual saving in labor cost greater than estimated, and is having a marked effect in holding the operating cost of the distribution departments in spite of the large increases in labor and material prices.

In conclusion, the "Spectator" wishes to emphasize the fact that the observations made above are not designed to be comprehensive, but as stated earlier merely throw sidelights on a few salient features on the several properties mentioned.

New Cars for Metropolitan Railway, London

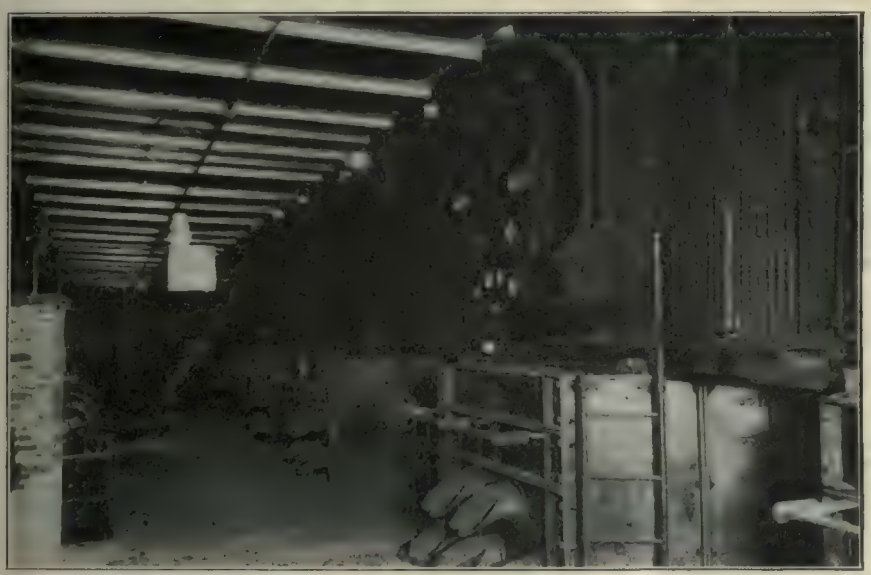
The first train of an improved type of cars has been commissioned by the Metropolitan Railway, London. This contains six cars, the first installment of an order for 100 cars. Pictures and diagrams of the cars were given in a recent issue of the *Electric Railway and Tramway Journal*, which states that the feature of the new train is the provision of five swing doors on each side of each car in place of the two or three sliding doors hitherto prevailing. The underframes and trucks of the cars are identical with earlier ones, but the seating has been rearranged to give a total of 292 seats as compared with 268 seats previously furnished. No straps are provided for the use of "standees," but in their place "steadying" rails are provided on seat backs and doors.

Pulverized Coal for Fuel Makes Good Saving in Milwaukee*

Ease With Which Fuel Feed and Draft Are Controlled, Ability to Take and Drop Heavy Overloads Quickly Without Waste, Thorough Combustion and Uniformly High Efficiency Are Chief Advantages of Pulverized Coal

BY JOHN ANDERSON
Chief Engineer of Power Plants, The Milwaukee Electric Railway & Light Company

THE cost of installing and operating the plant necessary for pulverizing and drying will always determine the advisability of adopting powdered coal for steam generation in any one location. This plant comprises equipment for separating tramp iron from the coal, for crushing the coal to a size suitable for drying and feeding to the pulverizer, for removing the moisture, and finally grinding it to the desired fineness. In recent times the extra investment required for the burning of pulverized coal has become less an obstacle than formerly. The soaring price of coal has prompted thorough investigation of any process which holds promise of greater efficiency.





AT LEFT—FRONT VIEW OF PULVERIZED COAL FURNACE IN ONEIDA STREET POWER PLANT, MILWAUKEE.
AT RIGHT—THE REVOLVING COAL-DRYING CYLINDER

These considerations led the Milwaukee company to begin two years ago the installation of pulverized fuel-burning furnaces and the necessary equipment on first one and later four additional 468-hp. boilers in the old Oneida Street power plant. This station contains ten boilers, the other five being equipped with Riley stokers. After much development work and many changes in design, these five boilers, burning pulverized coal, were put on comparative test with the five stoker-fired boilers in the same plant. The summary of this test is given later in this paper. The general experience gained from the use of the pulverized coal plant and furnaces is summarized in what follows:

As the coal is received at the plant in the form in which it leaves the mines, it is necessary to pass it over a magnetic separator which removes all tramp iron, such as bolts, nuts, pick-points, etc., as a safeguard against damage to the pulverizing and conveying machinery. A crusher must be used to reduce the green coal to a size suitable for proper drying and pulverizing, unless coal can be procured in sizes smaller than ½ in. screenings without sacrificing heat value.

The fuel is next dried. The object is to bring it to a condition in which it can be most easily pulverized and most uniformly controlled by feeders into furnaces. In a pulverized-coal-fired furnace, most uniform temperature conditions are obtained with dry coal. Moisture in varying or large quantities in pulverized fuel definitely prevents a regular controllable flow of mixed fuel and air to the burners. For the removal of moisture, a mechanical dryer which reduces the water content of the fuel to about 1 or 2 per cent, is installed. This dryer usually consists of a double rotating cylinder, so arranged that hot gases from a small furnace are passed through the coal as it travels by gravity through the shell of the dryer and is delivered to the pulverizers.

The dried coal is next fed into the pulverizers. The fuel is ground to an impalpable powder, varying in fineness to pass from 80 per cent to 85 per cent through a 200-mesh screen. This process completes the preparation cycle and the coal in this form, after being conveyed to storage bunkers adjacent to the furnaces, is ready for firing.

Dust collecting and reclaiming equipment, although

*Abstract of paper presented at Feb. 19 meeting of the technical section of the Employees' Mutual Benefit Association, The Milwaukee Electric Railway & Light Company.

only auxiliary to the drying and pulverizing machinery, is of great importance in securing the most economical as well as the cleanest operation of a preparation plant.

The cost per ton of preparing coal depends upon the size of the plant and the quantity of fuel handled, but ordinarily will vary between the limits of 25 and 50 cents. It would seem that a great deal of work toward reducing this cost remains to be done, especially along lines of utilizing waste gases for drying, in plants not provided with economizers. Development of a furnace design which will permit of burning a large percentage of finely divided coal, but capable of taking care of a smaller amount of larger sized particles, presents further study along this line. This is possible in view of the fact that the pulverizers consume about 86 per cent of the total electric energy required for all moving parts of the coal preparation equipment. Both of the items mentioned above, if capable of being reduced as suggested, will also cause a reduction in the cost of the pulverizing department labor.

Continuous and uniform operation of the pulverizing division of a plant is dependent largely upon the ability of the operators to recognize and meet the varying properties of the coal as it arrives. Dryer operation especially must be changed frequently so as to handle varying sizes of coal (from high percentages of dust to high percentages of small nut) and varying amounts of moisture, both inherent and surface, and yet supply continuously a coal of uniformly low moisture. Irregularities in the drying process usually manifest themselves throughout the entire coal cycle, and very often with the result that the fuel feeding system becomes plugged at points most readily affected by wet coal.

Little need be said concerning the equipment which feeds the fuel to the furnaces. Feeder screws driven by variable-speed motors carry the fuel from the storage bins to the air mixing chambers from which it is blown as a mixture through pipes to the burners and then into the furnaces. The feeder motor controls at the Oneida Street plant are all provided with cutouts and if at any time the air blast to the mixing chambers and burners is lost due to a blower shut down all coal feeders are automatically stopped, thereby preventing serious plugging with attendant interruption to operation of boilers for what could easily be a considerable period. Air in addition to that used for carrying the fuel into the furnace is taken through auxiliary inlets located in the furnace front, and this can be varied in amount by manipulation of the stack damper which serves to change the gas velocities through the boiler and thus the volume taken into the furnace. With coal and air supplies easily adjustable, perfect fire control is assured and it becomes at once obvious why coal is burned so efficiently in pulverized form.

More Efficient Combustion Can be Secured

In further explanation of this it is well to consider briefly the indications of efficient combustion applied to the steam boiler. Chief among these is the percentage of carbon dioxide, CO_2, the product of complete combustion, which is found in flue gases. Next in importance is the percentage of monoxide, CO, a product of incomplete combustion, which may be found at the same time.

The condition desirable is that with the percentage of CO_2 as high as practical there should be no CO—a condition obtainable to a greater degree in a pulverized feed furnace than in any other type. Complete combustion with the least amount of excess air requires the best distribution of that air and the problem of furnace efficiency therefore resolves itself mainly into one of air supply, not to the furnace alone but to each particle of coal. With a fuel finely pulverized, air can be made at once available to each particle since the surface exposed to air is increased to many times that of a lump and combustion is rapid, complete and efficient. With fuel in lump form, air must be supplied through a bed, the outer surface of the lumps must be burned off, the process of combustion eating into the lumps slowly. As a result combustion is often gradual and unequal. Where the fire is thin too much air is passed; where it is heavy there is too little air. To insure complete combustion in any furnace some excess air must therefore be provided. The use of pulverized fuel reduces this excess to a minimum, gives a higher and more uniform percentage of CO_2 and therefore a higher and more uniform efficiency.

The percentage of CO_2 to be maintained in pulverized fuel practice is determined to a great degree by furnace limitations rather than combustion consideration. From 16 to 17 per cent CO_2 in the flue gases is easily obtainable but it cannot be maintained in actual operation due to the exceedingly high flame temperatures that result and the consequent destruction of the brick work. The temperature of the furnace therefore must be regulated by varying the volume of excess air. The temperature of the flame should not be above 3,000 deg. F. and that of the brick work in the flame zone not more than 2,400 deg. or 2,500 deg. F. Higher temperatures than these usually result in fusion of the ash particles and formation of a molten slag which is very destructive to the brick work with which it comes in contact.

In attempting to carry combustion conditions of a furnace so as to obtain exceedingly high percentages of CO_2 usually too little attention is given to the losses resulting from the formation of carbon monoxide, CO. Carbon monoxide, a highly combustible gas, is formed when the excess air admitted to the furnace is insufficient properly to surround and completely oxidize all the coal particles. Heat losses occurring when CO is present in the gases of combustion, outweigh any gains that may be effected by an exceedingly high CO_2 percentage.

Adaptability to Various Grades of Coal

In the discussion of furnace efficiencies consideration should be given to the adaptability of a pulverized fuel fired furnace to the use of widely varying grades of coal without resultant losses in economy. Further, boiler capacity, even under heavy overloads, is in no way effected when an inferior quality of coal is burned. It is known that the combined efficiency of a boiler and furnace does not decrease when the fuel is poor, which condition does not hold true for the stoker. In the case of the stoker, the dropping off in efficiency is at a more rapid rate than the B.t.u. value of the fuel would indicate as normal, and so much so, that the point is rapidly reached when proper combustion cannot be maintained.

Operation of a pulverized fuel fired boiler, equipped with proper instruments, can be varied to take big fluctuations in load over very brief periods of time. A heavy overload can be quickly taken on or dropped off by adjustment of the coal and air feeds, and without any waste of fuel as always occurs under like conditions in stoker practice. No losses occur due to clinkering of coal or cleaning of fires, this condition of operation being

entirely eliminated. Irregularities caused by change in quality and variation in size of coal, such as the fireman cannot successfully cope with on stokers, are also eliminated. Furnace conditions necessary to most economical combustion are more perfectly obtained and hence a horizontal combined efficiency curve is possible of approximate attainment.

Due to its easily regulated coal and air supply and its perfectly controlled rate of combustion, the pulverized fuel furnace practically eliminates losses of combustible in ash. Ordinarily this loss is relatively large and varies according to the nature of the coal, type of stoker and the boiler load carried. In pulverized fuel practice the loss is very small and these variations do not occur.

An additional economy is effected during banked boiler hours. Banking conditions when operating with pulverized fuel are somewhat different from those obtained in stoker practice. By stopping the fuel supply and closing up all dampers and auxiliary air inlets, a boiler fitted for use of pulverized fuel can be held up to pressure for several hours. The furnace brick work having been heated to incandescence during operation, gives off a radiant heat which is almost all absorbed by the boiler rather than escaping up the stack intermixed with an excess of cooling air. Radiation losses only occur as against radiation plus stack and grate losses with the stoker.

Maintenance Features Good Now but Can be Improved

Commenting for a moment on the maintenance features of such a plant as has been described it is the writer's belief, based on two years operating experience, that the furnace brick work in a pulverized fuel furnace will stand up equally as well as a stoker installation, with a very great advantage in favor of the former due to the elimination of all iron work in the furnace or anywhere near the high temperature zones of the boiler furnace. Regarding the maintenance of the pulverizing plant equipment it has not been found that any great amount of maintenance is likely to be necessary, as all the equipment is of the slow moving type and many opportunities are afforded for applying the same concentration of effort that has been typical of the stationary engineer's work in improving equipment when defects or fast wearing parts are discovered. The pulverizing machinery manufacturers have done a great deal along this line, but there are still matters that can be improved upon by the engineer looking for the least troublesome as well as most economical plant from a maintenance standpoint.

Powdered fuel installations are not feasible in every location. The one limitation is the size of boiler plant to be served. A plant of less than 2,500 developed b.h.p. on a 24-hour operating basis should not consider using powdered fuel. The amount of coal pulverized per day, the cost of installation, and the labor for operating the preparation plant, when properly studied, will bring before those interested the reasons therefor.

In general, we have found the powdered fuel method applied to our furnaces a distinctly advantageous one. Our firemen prefer to operate such equipment rather than the stokers when it becomes a matter of choice. It has proved more economical as evidenced by the monthly coal bill. It seems to form less scale than in stoker fired boilers. There is absolutely no trouble from smoke, consequently no reduction in the ability of the boiler to absorb heat due to soot on the tubes.

The use of high sulphur coal which is so destructive to boiler tubes, breechings, smoke stack, and all other steel equipment found in a boiler plant is much less unsatisfactory when in pulverized form, since the low moisture content of the prepared coal reduces the opportunity for attack from sulphuric acid.

Although frequently cautioned against explosions, we have had no evidence that such caution is necessary. The reason for our freedom from such unpleasant occurrences is due almost entirely to a proper care in preventing coal from being dried too much and pulverized to a fineness beyond that necessary. Matters of this kind are in the hands of the operating engineers and do not benefit by highbrow application of theories. The engineer who is careful of his every-day equipment and keeps his plant free from accidents of every nature, can operate a pulverized fuel plant successfully without other assistance than his own experience.

Comparison of Costs and Net Efficiencies

ELECTRIC ENERGY AND FUEL CONSUMPTION PER TON OF COAL BURNED

	Pulverized Fuel System		Modern Stoker
Energy consumed by conveyors, crusher, elevators, dryers, fans and feeders, kw.-hr.	5.73	Stokers and Blowers, kw.-hr.	10.94
Energy consumed by pulverizer, kw.-hr.	16.72		
Total energy, kw.-hr.	22.45		10.94
Coal equivalent at 1.5 lb. per kw.-hr. lb.	33.68		16.41
Coal consumed in dryer furnace, lb.	25.66		
Total coal and equivalent, lb.	59.34		16.41

COST OF FUEL PREPARATION, FIRING AND ASH DISPOSAL

Labor—coal preparation	$0 143		$0 000
Labor—firing	0 112		0 140
Labor—ash removal (in plant)	0 025		0 064
Dryer fuel—coal at $4.00 per ton	0 051		0 000
Electric energy—coal per kw.-hr. at 1.5 lb.	0 068		0 033

MAINTENANCE

Labor at $0.036—material at $0.020 Manufacturer's estimate (Lubricants at $0 007)	0 063	Labor at $0.046 Material at $0.049 Lubricants at $0.002	0 097
Total cost of fuel preparation, firing, ash disposal and maintenance	0.462		0.334
Price of coal as purchased, per ton	4.000		4.000
Total cost, per ton	4.462		4.334
Cost per ton of coal in p. f. system over modern stoker	0.128		

EFFICIENCY

Actual gross efficiency, per cent	80.67		76.80
Net efficiency after all incidental costs have been accounted for, per cent	72.32		70.88
Difference in favor of pulverized fuel system, per cent	1.44		

Pulverized Coal Equipment at Oneida Street Station

In the Oneida Street plant the equipment and the route of the fuel through the drying and pulverizing plant are in outline, about as follows: The coal is delivered to the station by barge and run over an automatic scale, discharged onto a short belt conveyor equipped with magnetic separator pulley for removal of tramp iron, and then into a Peck carrier, which takes it to the green coal storage bunkers, the starting point of the plant proper. From there it is conveyed and elevated to a Jeffrey disintegrator where it is prepared for drying by being crushed, and then discharged into a small storage bin and fed to the dryer. The dryer is of a double shell type and is so arranged that the gases exhausted from it are discharged through a cyclone separator where coal dust, carried from the shell, is reclaimed and conveyed to the pulverizers. The gases discharged from the separator are vented into the smoke stack. The dried coal is carried from the dryer discharge by a bucket elevator to the dry coal storage bins, to which are connected the pulverizer feeders. The pul-

verizers are of the five-roll Raymond type. Pulverized coal from the mill outlets is conveyed by screw conveyors to the pulverized fuel storage bins. Screw feeders take the fuel to the air mixing chamber from where it is blown to the furnace.

COMPARATIVE TESTS OF FIRING SYSTEMS

In order to learn the relative operating costs and net efficiencies of pulverized coal and modern stoker firing, a test of 99 hours' duration, 495 boiler hours, was run on Nov. 11 to 15. Complete data were taken on the five stoker-fired Edge Moor water tube boilers and this compared with corresponding data on the stoker-fired boilers taken at another time, but with the boilers maintained at 120 per cent full load in each case to secure similar conditions. The summary comparison is given in the table on page 475.

Discussion of Mr. Anderson's Paper

BY PAUL W. THOMPSON
Technical Engineer of Power Plants, Detroit Edison Company

There is at the present time a considerable difference in opinion among engineers as to the feasibility of burning pulverized coal in central generating stations, and as to whether, taking all facts into consideration, the use of pulverized fuel will result in a net saving over the results obtained with modern stoker installations. It is to be presumed that a general comparison of any two plants, one equipped with stokers and one equipped for the preparation and burning of pulverized fuel, would probably not give results which could be readily comparable in determining the ultimate relative value of one method of burning fuel over the other because of the probable different conditions of operation and the difference in design, kind and cost of fuel, cost of labor, etc.

It is unnecessary to go into the details of the Milwaukee test. It is sufficient to say that the test was properly conducted and particular care exercised in obtaining an accurate record of all quantities involved. The water and coal were weighed and the scales checked for accuracy at frequent intervals. All blow-off piping was disconnected from the boilers to preclude any possibility of error due to leakage. The boilers were subjected to regular normal operation except the rating was held at practically a constant figure, and no special effort was made to obtain an efficiency which would not be obtained under normal plant operation.

During the test the writer availed himself of the opportunity of watching carefully the boiler room operation and also the operation of the pulverizing, drying, and coal handling equipment and was very favorably impressed with the installation from an operating viewpoint.

The boiler room operation was indeed much simpler than is obtained with a stoker installation. The rate of steaming of the boiler is controlled by varying the speed of the feeder motor and adjusting the damper to take care of the different quantity of flue gas. It is unnecessary to look into the furnace at any frequent interval as is the case when firing with stokers and where holes in the fire or heavy spots must be corrected. In fact when once the feeder speed is set to give a certain rate of steaming of the boiler there seems to be no reason why this rating could not be maintained continuously, as far as the furnace is concerned, without it being necessary to make any changes whatever. Variations in the kind and quality of fuel burned seemed to have no effect on the operation except that when fed at a constant quantity, the rating of the boiler varied with the heating value of the coal. At one time during the test Youghiogheny was used, which coal had a higher heating value, higher volatile content, less ash and less sulphur than the mixture of Youghiogheny and Kentucky coal which was used throughout the remainder of the test.

Losses which are inherent in stoker practice such as, breakdowns in the stoker itself, breaking up clinkers, loosening clinkers, continually watching the fire to maintain correct and uniform thickness, watching the gas passes of the boiler to see that there are no large sparks which indicate a carrying away of combustible, dumping and the many other operations that are necessary in stoker operation, are eliminated. In other words, efficient combustion is obtained at all times without continual supervision by an experienced operator and from the standpoint of reliability of operation the odds are in favor of the pulverized fuel. This is an item for serious consideration in plants designed with 4.5 kw. capacity or more per installed boiler horse power, where the losing of a boiler due to stoker trouble at the time of maximum load on the station may seriously overload the remaining boilers or make it necessary to drop a portion of the load on the plant.

The handling of the ash resulting from combustion of the pulverized fuel is a very simple matter due to the very small quantity which is deposited in the furnace. It is in the form of a very fine impalpable powder which during the test was removed twice each 24 hr. On several occasions during the first and second day of the test, slagging occurred in a furnace due to not admitting a sufficient quantity of air. The direct cause of this was the over-anxiousness on the part of the men conducting the test, to obtain a higher per cent of CO_2 in the flue gas, and the reduction in the excess air permitted the furnace temperature to rise to a point where slagging occurred. The removing of this slag from the bottom or floor of the furnace presented more difficulty than is usually experienced in removing the refuse from the ash hopper of a stoker fired boiler. This slag had to be broken up and pulled out before it fused to the brick lining of the furnace.

It appeared to the writer that this formation of slag could have been almost entirely eliminated by a more frequent inspection of the floor of the furnace and the admitting of more air through the openings in the front of the furnace if it was found that slag was beginning to form. Even at times of removing this slag it was possible to maintain the rating on the boiler by increasing the coal feed, which, however, resulted in a decreased efficiency during this time amounting to about 45 min. in 24 hr. for each boiler. A large portion of the ash resulting from combustion is carried on through the passes of the boiler and out of the stack. Owing to the fineness of this ash it is apparently carried a considerable distance even in a moderate wind before being precipitated. Throughout the test there was a moderate wind blowing probably between 4 and 8 m.p.h. and the writer was unable to find any noticeable deposit in the streets. Even at the time of blowing the deposit of ash from the boiler tubes, which was done three times a day, requiring about 20 min. per boiler for each blow, no noticeable precipitation of ash could be found in the streets. At no time during the test was there any tendency for slag to form on the tubes of the boiler.

Strictly speaking there is no such thing as a banked

boiler when using pulverized fuel, since all that is necessary when it is desired to cut out a boiler is to shut off the coal feed and close all the dampers and auxiliary air inlets to the furnace. In this way the Milwaukee company found by test that it is possible to hold the boiler up to pressure for about 10 hr. by the radiant heat stored up in the furnace and boiler setting which is gradually absorbed by the boiler.

The loss which occurs and which can be compared to the banking loss in a stoker fired boiler is the heat which is radiated from the boiler and setting and equivalent in amount to that required to heat up the boiler and setting again to the temperature attained when steaming. In a plant where the ratio of boiler hours to boiler steaming hours averages 43 per cent or greater, which corresponds to an average daily plant load factor of 67 per cent, the saving resulting from the use of pulverized fuel is worth considering. Assuming 0.2 lb. coal consumed per boiler-horsepower banking hour in a plant equipped with underfeed stokers, this loss amounts to about 1.5 per cent, which, in a pulverized fuel burning plant, should easily be reduced to one-half this figure, resulting in a net saving of 0.7 per cent on this one item of the banking alone.

Operating Conditions During the Test

The conveying and preparation of pulverized fuel presents a somewhat more complex problem, although the present equipment in the Oneida Street Station is operating satisfactorily, and during the test operated without any serious interruptions. Moisture in the pulverized fuel caused by sweating on the inside of the pulverized fuel bins resulted in some feeder troubles but this was only a temporary condition and was overcome by closing the windows just above the bins, stopping the cold air from blowing directly on them. One of the feeder pipes between the bin and the furnace became partially plugged up due to a paper composition gasket becoming lodged in the pipe just above the burner. The boiler on which this occurred was operated for at least 24 hr. at the desired rating by increasing the feeder speed on the other burner until the trouble was located and removed. During this period the efficiency of combustion was undoubtedly below the average as the coal which did come through the plugged feeder was not fed in with the correct quantity of air due to the obstruction in the feeder pipe. No trouble was experienced with the dryer or pulverizing mills at any time during the test.

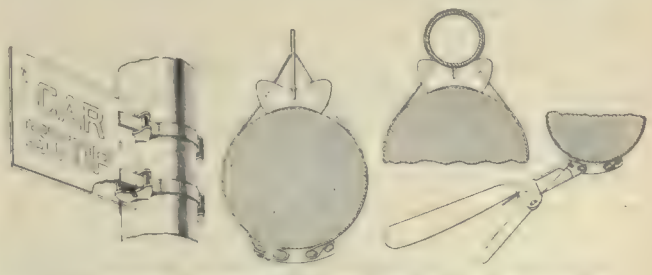
The writer does not believe that under *test* conditions over a period of constant boiler rating the efficiency obtained with the use of pulverized fuel will exceed that which has been obtained from the best stoker practice under similar operating conditions. However, under normal operation it is believed that the elimination of the many variable conditions entering into stoker operation will result in higher efficiency for the pulverized fuel installation. Overall efficiencies of boiler, furnace, and grate as high as 82 or 83 per cent, have been obtained on test with stoker fired boilers but normal operation day in and day out seldom exceeds 76 per cent in the very best practice where highly skilled help is employed in supervising the boiler room operation. The gross overall efficiency of boiler and furnace of 70.6 per cent as obtained from the results of this test would unquestionably have been higher had the boiler been cleaned prior to the test. As a matter of fact each boiler had been in operation prior to the test approximately 600 hr. since being entirely cleaned, including approximately 300 hr. on three of the boilers since cleaning the first four rows.

Inasmuch as the boiler feed water consisted of approximately 90 per cent untreated water, the scale formation in the tubes would tend to give a lower efficiency than would have been obtained with clean boilers. At the time of writing this paper it has not been possible to open up the boilers and ascertain the exact amount of scale on the tubes.

Certainly the results obtained in the pulverized fuel burning plant as a whole, where the equipment was installed and made to fit into an old plant originally equipped with Jones stokers, are encouraging enough to warrant serious consideration of the use of this kind of fuel in stations to be built in the future. There are many improvements which can be made in the design of a new plant, especially in the design of furnace, location of drying and coal pulverizing equipment, method of coal handling, drying and pulverizing, method of ash handling, slag prevention, possibility of using waste gases for the drying of fuel—all of which will have an effect on the efficiency which may ultimately be obtained. The application of pulverized fuel to central generating stations has been in use to a very limited extent for several years, but there still remains much experimental work to be done before we can hope to exhaust all the possibilities for increased efficiency, and bring it to as high a state of development as is the stoker at the present time.

New Fastening for Pole Attachments

A NEW fastening for car stop signs, conduits or other fittings which require attaching to tubular steel or concrete poles has been placed on the market by the Bush Electric Company, Cleveland, Ohio. Accompanying illustrations show how the fastening is applied. It consists of a band placed around the pole, drawn through a seating clip and clamped in such a manner as to hold the sign or conduit firmly against the pole. This tightening is made of a cinching tool which may be set at



CAR STOP SIGN APPLIED TO POLE, AND METHOD OF FASTENING

any point on the loose end of the band to give the desired tension. After the cinching tool has been brought around against the pole, the loose end of the band is fastened by bending over the fastening lugs.

The principal advantage claimed for this fastening is that it will fit any pole, regardless of size, including tubular steel poles which are built in sections, the diameter decreasing towards the top, and concrete poles which are tapered from the ground up. The same equipment may be used on all sizes and shapes of poles and the bands can be carried in rolls and cut off to any desired length. All parts are weatherproofed to prevent rusting.

Revised Schedules Bring Gain

The International Railway of Buffalo Is Giving Better Service with Fewer Car-Miles—The Methods of Determining the Number of Cars Required and of Drafting the Time-tables Are Described

THE tables in the accompanying panel show what was done by the International Railway in one year by adjusting service to traffic. During the war the heavy demands on the system for the transportation of war-workers, added to the severe cold and storms experienced during the winter 1916-17, affected the operation adversely, and there was considerable criticism of the schedules in consequence. This led the company to make an extended review of the entire subject of the make-up of its time-tables.

Statement of Operations, International Railway

	For Calendar Year 1919	1918
Passenger revenue	$8,970,689	$7,167,371
Car-hours	2,442,434	2,284,352
Receipts per car-hour	$3.67	$3.13
Car-miles	22,355,365	20,655,019
Receipts per car-mile	$0.401	$0.347
Speed in miles per hour	9.1	9.1

	For Nine Months Ended September 30 1919	1918
Passenger revenue	$6,694,808	$5,689,744
Car-hours	1,833,314	1,833,315
Receipts per car-hour	$3.65	$3.10
Car-miles	16,739,825	16,582,453
Receipts per car-mile	$0.400	$0.343
Speed in miles per hour	9.1	9.0

In this study a special effort was made to adjust the service to the actual traffic demands. As will be explained later, certain notable savings in car miles and car hours were made principally in turnbacks, although few or no changes were made in the downtown district except in some cases to add cars. There was also some re-routing. By these changes, during the first nine months of 1919, under the new schedule, the passenger revenue was increased more than a million dollars, while by a coincidence the car hours were just one less. The figures for the twelve months are of a like nature.

In explanation of these changes in schedules it should be said that the company exerted every effort to keep the cars on time, the theory being that a 5-minute schedule well maintained is more satisfactory to the public than a 4-minute schedule not kept up. The improvement in service thus effected was generally acknowledged in the public press, and the mayor as late as July 17, 1919, expressed the opinion that the company was giving "super service." It should be added that the figures given are those of the company as a whole and that the same fare was charged on the city lines during both periods. On the interurban lines, by order of the Public Service Commission, an increased fare was collected, beginning May 1, 1919. The total additional revenue thus collected was $206,379, but this amount of money is not included in the passenger revenue totals for the year, as given in the tables on this page.

It is the purpose of this article to describe the way in which the investigation was conducted, and how the time-tables were prepared. The work was undertaken by John O. Weigel, general superintendent of transportation. Mr. Weigel came to the International Railway from the Brooklyn Rapid Transit Company, where he had had charge of the construction of time-tables.

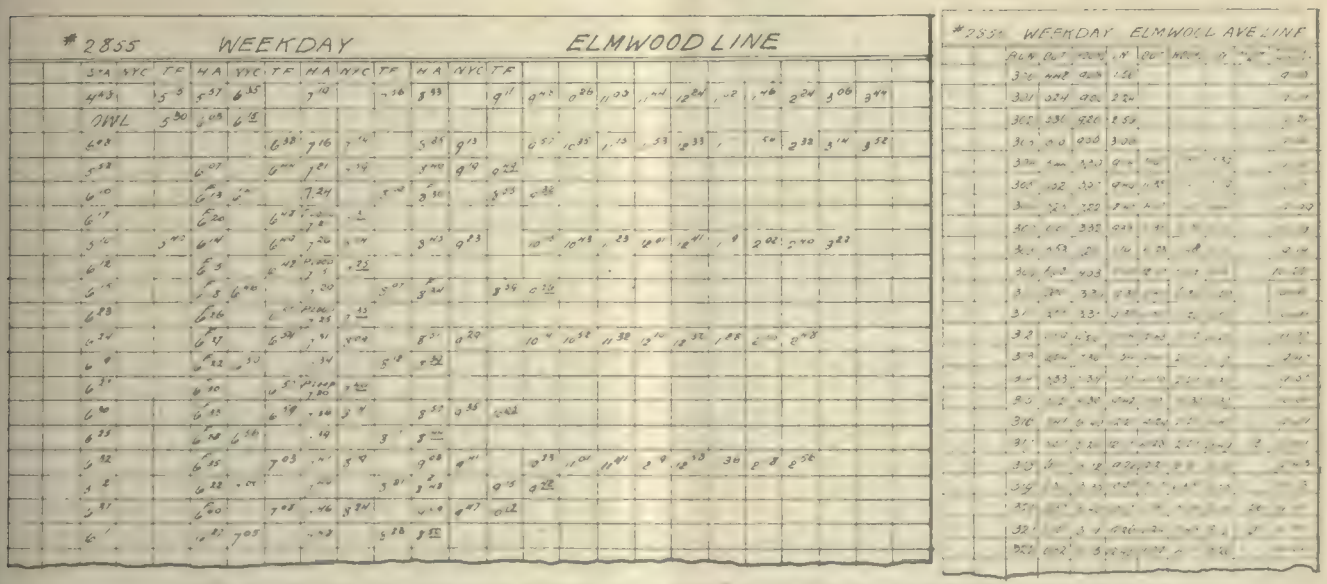
The first step was to take a traffic count at certain strategic points on each line. These counts were taken by checkers, of whom only a small number was required, because they would go from line to line and would check only at the times when a preliminary investigation by a higher transportation official indicated that a check was necessary. The blanks used gave the car number, time, headway, number of passengers passing the point, and weather. As a rule, the points selected for such counts were half or two-thirds of the way out from the center of the city, where there were cross-overs, so that cars could be turned back. Most of the changes in the time-tables were made in the non-rush hours.

A typical record passenger count is shown in the forms below. From the conclusions indicated by these counts the time-table was made up.

Several fundamental principles were recognized in the time tables thus drafted. The first of these was that if possible at least every other car would be run through



TYPICAL PAGES FROM PASSENGER COUNTS

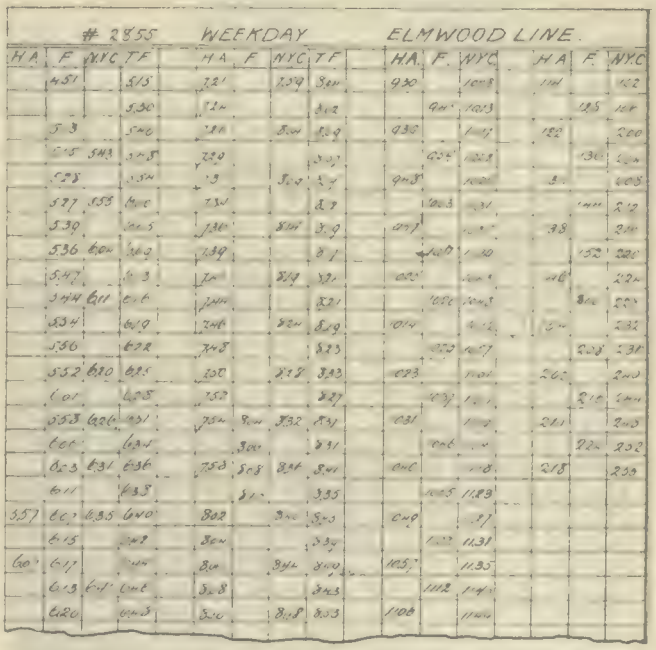


UPPER PORTIONS OF CAR-RUN SHEET AND CREW-RUN SHEET, ELMWOOD AVENUE LINE

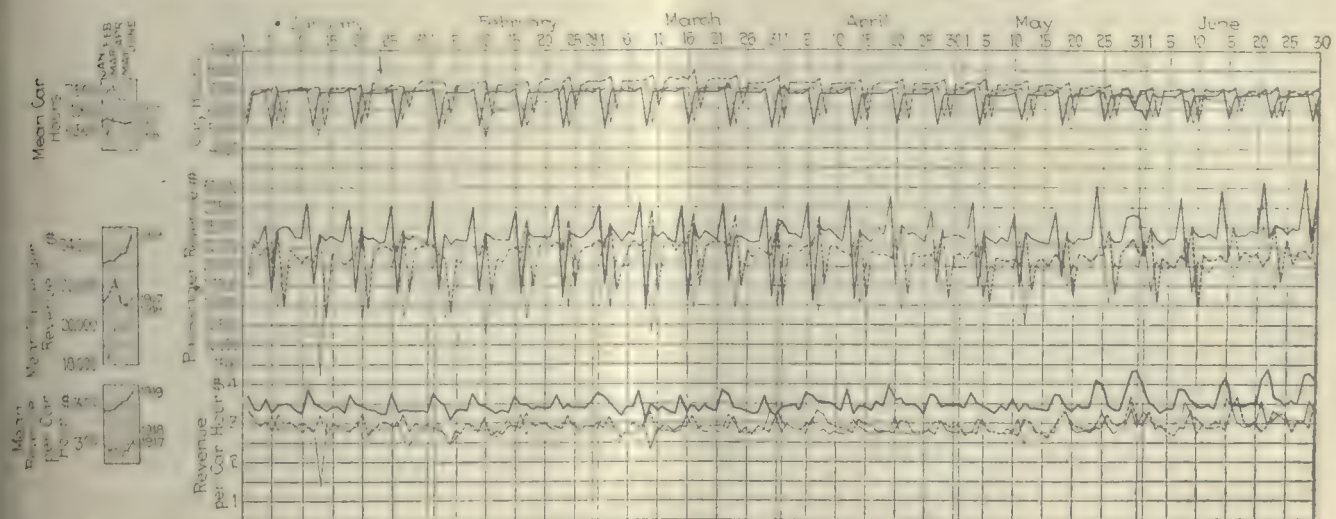
to the end of the line. A second principle was that every effort should be made to keep the headway regular. A third was to run at least as many cars, if not more, during the rush hour and in the downtown district.

The second step in the preparation of the time was the drafting of the "headway layout sheet." The upper part of such a sheet, for the Elmwood Avenue line, is given in an accompanying form, in which the time points from north to south are Hinman Ave., Forest, Terrace and Franklin and New York Central. As will be seen, cars are started south from the carhouse at Forest Ave. on this schedule as early as 4:51 a. m., but do not begin running from Hinman Ave., the north end of the line until 5:57 a. m. From 6.32 to 8:10 practically every car going south starts from the outer end of the line at Hinman Ave., but after that time only every other car starts from the outer end of the line. In the same way, during the non-rush hours, only every other car goes as far south as New York Central.

From this layout sheet, the car runs are compiled, as shown in the upper part of the car-run sheet for the same line, and from the car-run sheet the crew-run sheet is compiled. In the crew-run sheet shown all of the runs are either one-piece or two-piece runs.



PORTION OF HEADWAY LAYOUT SHEET, ELMWOOD AVENUE LINE



THIS CHART SHOWS THE BETTER RECORDS PER CAR-HOUR DURING 1919 AND ATTRIBUTABLE, IN THE OPINION OF THE MANAGEMENT, LARGELY TO MORE CAREFUL SCHEDULE MAKING

Contrary to the conditions on some properties, Sunday is a day of light traffic. This fact is emphasized in the chart of car miles, car hours and receipts for the first two quarters of the last three years, in which the weekly peaks represent Saturdays and the weekly valleys represent Sundays.

While much was done in the way of schedule adjustment to secure the results shown in this chart some rerouting was also done on the downtown lines. This relieved the congestion during the rush periods on Main Street and also made quite a material saving in car hours per mile.

The number of cars required to operate the schedule in force during January, 1920, was:

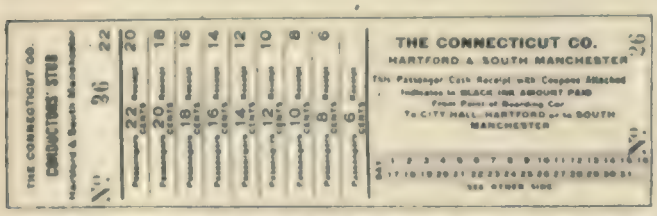
During the morning rush period	584
During mid-day	303
During the afternoon rush period	692

New Ticket for Zone System

Connecticut Company Adopts New Method to Facilitate Unloading at Termini of Heavy Interurban Runs

IN ORDER to facilitate unloading at the end of heavy interurban runs, the Connecticut Company is inaugurating on Sunday, March 7, a new method of zone fare collections for all passengers who go through to the terminus. This is being applied to two lines at first—the Hartford-South Manchester and the New Haven-Waterbury. One of the tickets used under the new method is shown in the accompanying cut.

As previously described in these columns, under the present zone system of the Connecticut Company each passenger is given a "zone check" by the motorman as



NEW TICKET FOR ZONE FARE COLLECTION ON INTERURBAN LINES

the former boards the car; the fare deposited in the fare box is then calculated by the passenger and conductor from this zone check. This system has worked well in general, but at the termini of heavy interurban runs there has been some delay in unloading the usual large number of passengers at the one point, owing to the time consumed in making change and collecting from passengers coming from so many different zones.

Under the new scheme, the same method of fare payment is followed for all passengers getting off before the terminal zone is reached. But for those going through to the terminus, the conductor will collect fare and give receipt en route, or under a "pay within" plan. Fare is calculated on the same basis as before and figured from the zone check the passenger holds. Then, if the fare is 16 cents, the conductor tears the ticket on the line between 16 cents and 18 cents in the central line of figures, punches the date in the body of the "Passenger Cash Receipt" attached. This is handed to the passenger and is to be deposited by him in the receipt box as he leaves the car at the terminus. The other portion of the receipt is turned in by the conductor with his other daily records and shows, in red, at the lowest right hand figure the fare he has collected on each ticket.

As seen, this method does not preclude the payment of zone fares according to present practice in case the conductor has not collected from all passengers, but is merely a means to facilitate the unloading of cars at the termini.

Closed System of Turbo-Alternator Ventilation

IN AN article in the current issue of the *General Electric Review*, George Monson gives valuable information on turbo-generator cooling. He points out the importance of sending clean air through the ventilating ducts because the volume required is so great that even a small amount of dust in a unit of volume may seriously clog up the spaces. For example, some conception of the magnitude of the quantities involved may be had from the fact that a 30,000-kw. machine requires approximately 6,000,000 lb. (81,000,000 cu.ft.) of ventilating air in a 20-hr. run.

The closed air circuit system of ventilation offers certain advantages in insuring cool clean air. It operates in the following manner: The air enters the rectifier cooling chamber directly after leaving the generator. This chamber contains the water sprays which produce the cooling action. It then flows to the speed-reducing chamber where the water particles are segregated from the air flow, then through an eliminator chamber where the last vestige of water is removed from the air before it re-enters the generator. This system uses the same air continuously, and can be made to occupy a relatively small and compact space as compared with the present system.

The foundation directly under the generator is usually provided with a space which is occupied by the inlet and outlet airduct pipes. This space can be utilized to advantage for mounting the air rectifier. The cumbersome station ventilating ducts, including the room occupied by the air washing apparatus, will be eliminated, thereby simplifying the station construction considerably and saving space.

The air washer is used for cleaning and cooling the incoming air. By using the same air continually, and without any possible way for it to mix with impurities, the problem of cleaning is eliminated.

Engineering in Canada

In his inaugural address, delivered on taking the chair of the Toronto branch of the Engineering Institute of Canada, R. O. Wynne-Roberts discussed "A generation of engineering in Canada." In connection with the electric railways of Canada, he said that the first ones were built in 1890 from Windsor to Walkerville, and from St. Catherines to Thorold, but there may also have been a short exhibition line in Toronto at that time. These were followed by four miles each at Victoria and Vancouver and short lengths in one or two other cities. Official annual statistics in this field were compiled beginning with 1901, when the electric railway mileage in operation in Canada was 674. It is now 2,300. The capital invested is about $170,000,000 and approximately 500,000,000 passengers are carried annually.

New Power Supply for the St. Paul

Water Power Plants at Long Lake and Snoqualmie Falls Supply Electrical Energy at 100,000 Volts to Eight Motor-Generator Substations

THE formal inauguration of electric service on the coast division of the Chicago, Milwaukee & St. Paul Railroad was scheduled for March 5, the day on which this issue of the ELECTRIC RAILWAY JOURNAL goes to press. An account of the inauguration will be given in a later issue. Readers of the paper are familiar with the details of the line and the locomotives from the several articles which have appeared in it during the past three years. Two pictures of one of the substations have just come to hand and are reproduced herewith. They were furnished by the General Electric Company. An outline map of the line is reproduced from the January, 1920, issue of the *Electric Journal*, from which a part of the following information is abstracted:

The electrification of the coast division adds 207.4 miles to the 440 previously electrified in Montana on the Rocky Mountain and Missoula divisions, and it extends from Othello in central Washington to the shops in Tacoma at the Puget Sound end. There is still a 212-mile gap between the Montana and Washington sections to be electrified.

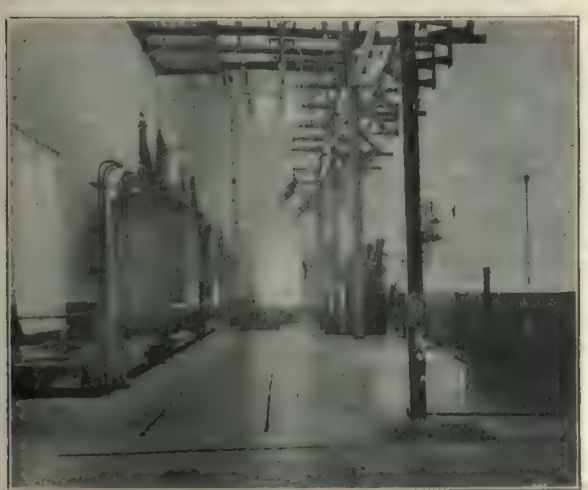


MAP OF PART OF C., M. & ST. P. R.R. SHOWING NEWLY ELECTRIFIED SECTION

All of the energy used on the new electrification is developed from water power, by the Washington Water Power Company and the Puget Sound Traction, Light & Power Company, through an organization known as the Intermountain Power Company. The Long Lake plant of the Washington Company and the Snoqualmie plant of the Puget Sound Company are the chief sources of power. This is delivered at 100,000 volts along the railroad's right-of-way, to eight substations as indicated by triangles on the map.

The contract between the Intermountain Power Company and the Chicago, Milwaukee & St. Paul Railroad specifies that the total demand of the railway company must not exceed a stated amount when integrated over a period of five minutes, and that the power payment be based upon this amount, with a maximum load factor of 60 per cent. For instance, if the denominated maximum is 10,000 kw., the railway company will pay for 6,000 kw. integrated over the month, whether this amount is used or not, and for amounts in excess of 6,000 kw., will pay at the same rate per kilowatt-hour. This requirement gives the railway company the benefits in cost of power generation that accrue because of high load factor. In order to meet the conditions of the contract it becomes necessary to totalize at every instant the whole load being taken into the railway system at the substations located at Taunton, Cedar Falls, Renton and eventually Tacoma. This load must be totalized in such manner that it can be measured by a maximum demand meter with a five-minute interval, as well as indicated and recorded. Also, in order to prevent the peaks of load usual to railway service from penalizing the road in additional power cost, the voltage generated at the substations is reduced automatically when the total load reaches such proportions that the nominated maximum demand is in danger of being exceeded. The result is a smoothing out of the load curve of the system by slowing down trains during the peak and spreading some of this load over the valleys of the curve.

Equipment for the substations is being supplied by the Westinghouse Electric & Manufacturing Company and the General Electric Company. Each of these companies has taken special precautions to guard against the occurrence of flash-overs on the direct-current generators at times of short-circuit on the 3,000-volt system. The substations whose equipment is supplied by the General Electric Company are provided with high-





AT LEFT, HIGH-TENSION ROOM IN CEDAR FALLS SUBSTATION. AT RIGHT, MOTOR GENERATOR ROOM

speed circuit breakers with a view to opening the circuit before the current has had opportunity to build up. The machines furnished by the Westinghouse Company are protected by the "flash suppressor," a device developed especially for this electrification.

Powdered Coal Plant at Seattle

Following Extensive Experiments the Puget Sound Company Installed 4,100-b.-hp. Plant — Well Arranged Equipment Increases Economy and Efficiency

THE Puget Sound Traction, Light & Power Company, Seattle, Wash., installed in one of its boiler plants, used for steam heating purposes, a complete equipment for burning pulverized coal, following the experiments described in the issue of the ELECTRIC RAILWAY JOURNAL for May 19, 1917. Fuel oil was previously burned in this plant, but the presence of a 225,000-ton culm heap near by, and the possibility of effecting considerable economy by utilizing it, induced the company to install a pulverizing and drying plant. The culm is from Washington lignite coal which has a fuel value of about 9,000 B.t.u. with 18 per cent moisture and 16 per cent ash. The culm itself contains 7,300 B.t.u. with moisture of 25 per cent, volatile matter 28 per cent, fixed carbon 26 per cent and ash 20 per cent. It costs $1.80 per ton f.o.b. the raw-coal bunkers.

Briefly the equipment may be divided into several parts, namely, that for handling raw coal, that for drying, that for pulverizing, that for burning and that for handling the ashes.

There are three wooden raw-coal bunkers, lined with galvanized iron, of a total capacity of 725 tons. The raw coal passes first through a gate and an auxiliary hopper (provided to prevent clogging) to a Mead-Morrison crusher, next by way of a belt conveyor to a bucket elevator, thence to a raw-coal flight conveyor, which distributes it over the bin provided for raw crushed coal. The capacity of the plant to this point is 75 tons per hour.

The 325-ton crushed coal bunker is of reinforced concrete. It branches into two hoppers with 10 in. x 5 ft. discharge openings in the bottom. From these 30-in. apron feeders convey the coal to dryers through 10-in. pipes, so arranged that either or both of the two dryers can be used. In these pipes are lines of paddles, motor-driven, to insure continuous flow. One horsepower is required for the set of paddles in each pipe.

The two dryers are of the indirect-fired rotary type, one of 7 tons and the other 10 tons capacity per hour. Induced draft for these is provided by two Sirocco fans, each driven by a Terry steam turbine. These fans discharge through cyclone separator heads. The dryers discharge into a dry-coal elevator, through magnetic separators which take out iron scrap. Thence the coal is distributed by means of a 12-in. screw conveyor over a dry coal bin through eight steel extension spouts. The dry-coal bunker is of reinforced concrete, with a total capacity of 160 tons. It is divided into four hoppers.

The pulverizing mill equipment comprises four Fuller-Lehigh 42-in. mills and one Raymond mill, the total capacity being 16 tons per hour. Each mill requires a 75-hp. motor. From the mills the spouts lead to a 12-in. screw conveyor and the powdered coal passes over an elevator to another 12-in. screw conveyor, leading to the bins above the boilers.

No cyclone separators or dust collectors are used with the Fuller mills, but the excess air is removed by a small induced draft fan, and is fed directly to the furnace. From the Raymond mill a large exhaust fan, driven by a 30-hp. motor, drives the air through a cyclone separator, from which the discharge leads to the above mentioned screw conveyor. There is also a small pressure relief fan connected to the separator to prevent accumulation of pressure.

As previously mentioned, a screw conveyor leads to the bins over the boilers, and across this are four 12-in. conveyors, each driven by a 5-hp. motor, feeding a bin of 16 tons capacity. Connecting with the bins are twenty-two screw-conveyor feeders. After experiments with several types of feeder, it was found that for the local conditions the Santmyer feeder was best and this is now used throughout.

Air for the feeders comes from two 50,000-cu.ft. Sirocco fans and two 3,000-cu.ft. Sturtevant fans, the latter being used for individual feeders. The feeders are driven by 1½-hp. Crocker-Wheeler motors.

The burners are especially designed elbows with three openings, one for the fuel, a smaller one for the air feed and a third for the discharge.

In adapting the boilers for the new fuel supply, Dutch ovens were added so as to give ample combustion chamber space. Ash crushers were installed also and a drag-chain conveyor was provided to transfer the ashes to an elevator which raises them to the ash bin.

The culm is loaded at the mines directly into coal cars by means of a Bagley scraper. It is delivered to the storage bunkers at night, two additional men being furnished to help the train crew in unloading the cars. One man takes care of the raw coal equipment, coal being transferred from the storage bunkers to the crushed coal bunkers sufficient for the twenty-four-hour run during an eight-hour shift. One man looks after the feeders supplying the dryers which, owing to the higher temperatures of the discharge, tend to clog up. Another man operates the dryers and mills. He has an assistant to look after the distribution of the dry coal and pulverized coal in the bunkers above.

Both mills and dryers are operated continuously. Pulverized coal is used as a fuel for drying, approximately one ton of pulverized coal being burned to dry twenty tons of raw coal.

The water tender takes care of feeders, which are regulated by controllers located on the boiler room floor. The machinery is kept in operating condition by an oiler. Two helpers keep the tubes clean by operating the soot blowers and a special steam jet inserted through the front of the setting. This operation is performed at 4-hour intervals. In addition to this the men also blow down the tubes.

Three additional helpers remove the ashes from the dryer settings, clean the combustion chambers when necessary and remove the ash deposits back of the bridge wall at regular intervals. This deposit is wetted down in the setting to facilitate handling and to avoid spreading of the dust. One cleaning a week is sufficient to take care of this deposit. The slag accumulating on the sides of the combustion chamber is removed at intervals varying from six to ten weeks.

The ash falling into the pit below is removed with

long rakes. The ashmen look after this work, while the third operates the drag chain and ash elevator and feeds the ash crusher. The ash in the pit consists of slag and powdered dust. The slag is pulled out near the door and cooled off with a stream of water. When sufficiently cool, it is pulled out under the runway in front of the ash pit where it is again drenched to speed up the cooling, after which it is fed to the crusher.

The above information is taken from an article in the Stone & Webster *Journal*, where additional details can be found.

Association News

Mr. Henry to Head Washington Office

W. V. HILL has resigned as manager of the Washington office to resume his duties as manager of the California Electric Railway Association, and Charles L. Henry, president Indianapolis & Cincinnati Traction Company, Indianapolis, Ind., and chairman of the committee on national relations will take over the active supervision of the affairs of that office. The office will be open continuously and all communications pertaining to matters of federal legislation, the Interstate Commerce Commission, or other federal departments or bureaus, addressed to Charles L. Henry, chairman committee on national relations, American Electric Railway Association, 950 Munsey Building, Washington, D. C., will receive prompt attention.

The Washington office is equipped to act as agent before the Interstate Commerce Commission for companies requiring this service and such companies as are not so represented or who desire to make a change in their present arrangement should communicate with Mr. Henry at Washington for the necessary authorization blanks. There will be no charge for the performance of this service other than a documentary tax of 25 cents required by the government and cost of telegrams or other unusual service involved.

Executives and others connected with member companies having business in Washington are urged by Secretary Burritt to make the Association's rooms their headquarters.

Information Bureau Activities

DURING February the following very considerable group of special reports and compilations was prepared by the association information bureau under the direction of its special engineer, J. W. Welsh:

Typical Exhibits of Electric Railways Used in Settlements of Wages and Working Conditions: This is an outline of a typical wage arbitration case, showing the essential elements, a brief statement of arguments and a number of actual exhibits used by member companies recently in the presentation of such cases.

Confidential Information Concerning Wages of Trainmen: Supplement No. 1 to bulletin No. 122, dated March 1, 1920. This supplement follows the plan of the original bulletin, showing the name of the company, miles of track, wage rates for each period of service and the dates of establishment and expiration of the scale.

Practice of Electric Railway Companies in Adjusting With Shipper Shrinkage in Coal Received by Boat or Rail: In response to a request by a member company, a questionnaire was sent to a limited number of companies to determine their practice in allowing for shrinkage in the weight of coal as shown by bill of lading and as actually measured on receipt.

Elements Entering Into the Determination of Fair Value of Public Utilities, Dated February 10, 1920: This is an appendix to a former compilation on "Official Valuation of Electric Railway Properties" and is based on extracts from decisions of courts and public service commissions.

Recent Decisions of Public Utility Commissions, Regarding One-Man Car Operation, Dated February 19, 1920: This is a compilation of abstracts of decisions and orders of public utility commissions regarding the operation of one-man cars.

Rentals Paid by Electric Railway Companies for High Tension Lines and Cables Over Bridges, Dated February 17, 1920: This report was prepared in response to a request by a member company and is based on replies received to a circular letter sent out by the association to a limited number of companies.

Effect of Increased Rates of Fares in Cities Having a Population Under 100,000, Dated February 16, 1920: This compilation is supplemental to the one reported last month which covered companies operating in cities having a population over 100,000. It shows the results for 57 companies.

Effect of Increased Fares for Companies Operating in Interurban Service, Dated February 16, 1920: This report covers a total of 28 companies.

Summary of Cities of Over 25,000 Population in Which the Fares Have Not as Yet Been Increased, Dated February 19, 1920: This shows the population, the operating company, present rate of fare and details as to pending applications.

Bibliography on Motor Bus Design and Motor Bus and Jitney Costs, Dated February 19, 1920.

Copies of the above will be sent to member companies upon request.

Some Safety Precautions in Winding Armatures

IN A RECENT issue of the *Safety Bulletin*, issued by the Bureau of Safety, Chicago, some precautions are enumerated which can be advantageously employed by armature winders. Among these precautions are the following:

Never allow water to drop into hot solder or babbitt metal.

Never stand directly in front of a banding lathe, where a banding wire is apt to strike you if it breaks.

Goggles should be worn when banding armatures and when slotting or turning commutators. A neat guard with an adjustable glass screen can sometimes be added to a slotting machine to prevent copper chips from striking the eyes.

Do not allow insulating paints that are mixed with alcohol, naphtha or other inflammable liquids to be poured from cans while near furnaces or torches. A 5-gal. can with about one quart of shellac in it exploded while a young man was shaking it within a few feet of a furnace. The explosion caused severe burns on his face and arms, and had it not been for the shopmen present, these might have proved more serious, if not fatal.

Make sure that the tailstock of the lathe is secure before starting to turn a commutator. Watch carefully the condition of slings, hooks or chain tackles and make certain that armatures are properly balanced so that they cannot slip.

Gears on turning lathes or field winders should be properly guarded.

Remember that fooling, horseplay or practical joking has no place in the armature room. Neglect of this will lead to accidents, poor standards of work and general demoralization of an otherwise efficient force.

Recent Happenings in Great Britain

Railway Wages Arranged — London Wants Four-Track Lines — Practically All Municipal Roads Have Raised Fares

From Our Regular Correspondent

The railway trouble is over. On Jan. 15 the negotiating committee of the National Union of Railwaymen accepted the terms as to standardized wages offered by the Government substantially in the same form as that in which they had originally refused them. The leaders of the men succeeded in persuading the latter to accept the Government proposal, but the course was adopted by only a very narrow majority.

Sliding Wage Scale

The standard wage in each grade is to be the average of the pre-war rate of grade plus 33s. war bonus plus 5s. A sliding scale is adopted by which wages move up or down by 1s. a week after September next as the cost of living goes up or down five points from 125 per cent above the pre-war rate. Should the cost of living fall to the pre-war rate, wages will never fall below double the pre-war rate. This settlement, along with the scheme of the Wages Board's, which I explained in my last article, should go far to prevent trouble in the future. Before the war the railway wages bill amounted to £47,000,000 a year. It will now come to £110,000,000.

A remarkable suggestion was made on Jan. 16 by Lord Ashfield (before his elevation to the Peerage, Sir Albert Stanley), chairman of the London underground railways. Speaking at a gathering of the London American Luncheon Club on the problems of traffic congestion in the metropolis, he threw out the proposal that not only should additional underground electric railways be constructed, but also that underground roads should be made, to be devoted exclusively to the use of fast automobile traffic, and connected in the outer districts with boulevards.

In dealing with the need of greater facilities for transportation, Lord Ashfield pointed out that a population of about 8,000,000 has to be dealt with over an area having a radius from the center of London of 20 to 25 miles. Not only is London the most populous, but it is the greatest riding city in the world. In 1914 the number of journeys per head of population was 303, while now it is 393 per annum. In reference to his proposal for more underground railways, he thought they should be brought up more to the standard of those in New York where there were local and express services.

Unions Support Fare Bill

The executive of the National Union of Railwaymen, contrary to the latitude of other trade unions, decided early in February to support the Parliamentary Bill of the London underground railway companies for an increase of fares. The N. U. R. sees that without the increase the underground companies will not be able to pay the higher wages under the recent agreement.

Some figures submitted by C. Owen Silvers, general manager of the Wolverhampton Corporation Tramways, to the Town Council in regard to fares indicate pretty clearly what has been done generally in England. A proposal was brought before the Council to reinstate the 1d. fare for short-distance journeys, but acting on the advice of the manager it was decided to adhere to the increased minimum of 1½d. Mr. Silvers stated that the running costs of the Wolverhampton cars were 6.651d. per car mile in 1913-14, but in 1918-19 they amounted to 12.366d. People, he said, seemed to have realized that in everything except tramway fares 2d. was now required where 1d. was enough in pre-war times. He found from returns he had received that fares had been raised on practically all the municipal tramway undertakings in the kingdom, and that the 1½d. minimum was now the usual practice.

Extension of Parcel Service

A good many of the British tramway undertakings have for several years carried on a parcel service successfully. In Leeds a new arrangement has now been adopted for the carrying of market produce on the cars. Suburban retailers make their purchases in a central market early in the morning, and they have hitherto taken their parcels with them on the ordinary cars, paying for them at the time they paid their own fares. Under the new arrangement the traders have to take their packages to a weighing machine in the market, where a tramway employee is in attendance to weigh and stamp the packages. The car conductors do not accept the parcels unless they have been stamped.

On the occasion of the amalgamation of the Metropolitan Carriage Wagon & Finance Company, with Dickers, Ltd., Mr. F. Dudley Docker, chairman of the former company, was presented by the shareholders with an illuminated address and a sum of money for the creation of scholarships at Birmingham University bearing Mr. Docker's name, to be competed for by employees of the Metropolitan Company, in subjects selected by him. The subscribers numbered about 1,100. Mrs. Docker received miniature portraits of herself and her husband mounted in gold. Mr. Docker occupies one of the most prominent positions in the British manufacturing world. He is a leader of the British Industries Federation.

The lorry omnibuses which had begun service in June last year were finally withdrawn from the streets of London in the end of January. Owing to the large number of omnibuses which had been sent to France for the purposes of the war and owing to the impossibility at the time of obtaining new ones, the London omnibus traffic became very congested. The War Office placed at the disposal of the London General Omnibus Company a number of military motor lorries. These were fitted for 'bus purposes by providing cross seats, an overhead canopy, and a door and steps at the rear. These vehicles reached a maximum number in service of 176 last November. They were never popular, though they eased the situation, because their springs were made to carry three tons, while the weight of the twenty-six passengers each could carry was only about a ton and a half. The company found that the working expenses exceeded the revenue by no less than 5d. per mile run, partly owing to low receipts and partly to high petrol consumption. Regarding the latter, the best result that could be got was 5¼ miles to the gallon, compared with 7 miles in the case of the ordinary omnibus, which carries 50 per cent more passengers. The company has got so many buses back from France it can now dispense with the use of the lorries.

The interesting statement was made at a meeting of the London County Council in the end of January that the average speed of the Council's cars is higher than that of the cars in any other city in the kingdom. In view of the great congestion of general traffic on many of the routes, this achievement is highly creditable.

Edinburgh Buses Satisfactory

Not long ago the Edinburgh Town Council as an experiment began running a service of five motor omnibuses as supplementary to the tramways. The plan has proved so satisfactory that it is now proposed to purchase thirty additional omnibuses at an estimated cost of £55,000. The tramways, which are still worked by cable traction, are congested owing to increase in the number of passengers.

Disaster fell on the English Electricity (supply) bill during December. So much opposition developed to it in the House of Lords that the Government dropped the part opposed till next year, when there will be more time, and proceeded only with the part on which there was general agreement. There has thus been cut out of the bill all the compulsory powers for the establishment of district electricity boards and for the acquisition of generating stations and main transmission lines.

The financial provisions have also been deleted, except one for an expenditure up to £20,000,000 for the erection of power stations and transmission lines. The part of the bill remaining provides for the establishment of a body called electricity commissioners, and the exercise through them of present powers and duties of the Board of Trade under the Electric Lighting Acts, with power to the commissioners to conduct experiments, and power to set up advisory committees.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Sliding Scale for Toledo

New Service-at-Cost Measure Provides for Added Return to Company for Efficient Operation

The service-at-cost ordinance drafted by a commission appointed by Federal Judge John M. Killits for settlement of the railway problem at Todelo, Ohio, will be submitted to the City Council for preliminary action on the evening of March 8. Council hopes to have the proposed ordinance ready for a referendum in connection with the presidential primaries on April 27. A month's notice must be given before the election.

Some Slight Modifications

The commissioners met during the week ended March 6 for the first time since the measure was submitted to Henry L. Doherty two weeks ago. Mr. Doherty has sent no reply yet. The commissioners heard the written reports of six lawyers who scanned the measure for technical errors and have since adopted a few new principles to go into the franchise ordinance.

Those who drew up the franchise have decided that it should contain a provision for a premium in the form of increased rate of return for economical operation of the system by the company, which will take over the traction business when the ordinance is adopted by the people. This premium is to consist of a one-quarter of 1 per cent increased return on the capital value for each half cent the rate of fare is lowered. Figured on an estimated capitalization of $10,000,000 and 60,000,000 riders annually, this would mean that the car riders would be saved $300,000 for each $25,000 the company receives in the way of increased return.

Chairman W. L. Milner, of the commission, declared such a provision would make the securities of the company more saleable and in that way help the financing of the railway. It was agreed that the increased return should accrue to the stockholders. With low fare and consequent high rate of return the stock would sell above par, the commissioners believe.

Maximum Fare Provision Retained

The maximum fare provision will be kept in the ordinance to win the popular support necessary for the adoption of the measure. Some commissioners believed it would be possible to eliminate the maximum fare provision with the premium on economical operation incorporated in the ordinance.

Mr. Doherty has never yielded on the maximum fare objection which he registered with the commissioners some time ago. This and the valuation question are the only major issues not definitely decided.

The commissioners also considered the cost of current which will be bought from the Water Street power station and the Acme Power Company, both Doherty properties. It is understood that the Acme plant does not come under the authority of the Public Utilities Commission as it sells power only to the Water Street station and other commercial users in Toledo. The commissioners will probably make the Acme Power Company a party to the contract in the ordinance and in that way secure the rate-fixing restrictions imposed by the Public Utilities Commission.

The ordinance must be passed by Council not later than March 22 if it is to be submitted at the presidential primary election.

The decision of the Supreme Court on the municipal ownership test case is expected soon. If it is favorable to public ownership and is received in time another ordinance providing for the bonding of the general tax duplicate for the purchase of the traction system will be submitted to the voters.

Franchise Extension Refused

The application of the Hudson & Manhattan Railroad, New York, N. Y., for another extension of time in which to begin building its line from Thirty-third Street and Broadway, its present terminus, to the Grand Central Terminal, was denied on Feb. 28 by Acting Transit Commissioner Daniel L. Ryan.

It was the seventeenth time the company had asked for an extension, and it will be the last, for the reason that its franchise expired on Feb. 29 and its options of real estate has lapsed. It cannot proceed with the work now without obtaining from the Board of Estimate another franchise. It was said that this would probably be denied by the board, for the reason that it would be deemed unwise to advance any project that would compete with city-owned transit lines.

The plan of the Hudson & Manhattan Company was to reach the Grand Central Terminal by extending its line to a point at or near Sixth Avenue and Fortieth Street, then running under Bryant Park to a point near Fifth Avenue and Forty-second Street, to a terminal under the latter street between Madison and Lexington Avenues.

Fear that the proposed extension would restrict the development of the city-owned lines was one of the reasons why property owners in the borough of Manhattan opposed the proposed extension.

Denver Arbitration Closed

Decision Expected Soon by Board Which Has Been Considering Wage Question

Indications pointed on Feb. 24 to a decision being reached very soon, by the board which has been considering the question of pay for the employees of the Denver (Col.) Tramway. Commencing on Jan. 19 public meetings were held by the arbitration board in the Council Chamber. Final argument was made on Feb. 10. Since then the arbitration board has held numerous conferences for the consideration of the data and the evidence submitted.

The demands of the men were made on Nov. 19, 1919, to a local board of arbitration under the agreement of Sept. 4, 1919, between the company and the union. The trainmen want an increase from the National War Labor Board award of 43 cents the first three months, 46 cents the next nine months and 48 cents thereafter, to 60 cents the first three months, 65 cents the next nine months and 70 cents thereafter with corresponding increases for the employees in the other departments, also time and a half for overtime, and changes in working conditions. The board of arbitration consists of two members, one appointed by the company and one by the union. The company's appointee was William G. Evans, former president of the Denver Tramway, while William C. Thornton, general agent of the Continental Life Insurance Company and also identified with local labor circles, was selected by the union.

The failure of the two members of this board to come to an agreement regarding the questions at issue and also regarding the selection of a third arbitrator led to intervention by the State Industrial Commission, which assumed jurisdiction on Dec. 29 in the effort to avert the possibility of a cessation of service.

Through the efforts of the Industrial Commission Hamilton Armstrong, chief of police of the city of Denver, was agreed upon as the third member of the Arbitration Board, the appointment being accepted by him and the Board completed on Jan. 13.

The railway is now collecting the 6-cent fare authorized by the municipal authorities during November, 1919. This ordinance, which contains no time limit, was passed by the municipal authorities following the defeat at a special election held on Oct. 22, 1919, of the tramway measures which were on the ballot and the subsequent expiration on Oct. 29, 1919, of the second 6-cent fare ordinance which had been granted. This last measure was limited to ninety days.

Detroit's Battle on in Earnest

Opposing Forces Line Up in Fight on Piece-Meal Railway Construction by City

As the date set for voting on the $15,000,000 bond issue for financing Mayor Couzens' proposed municipal railway system in Detroit, Mich., approaches, both parties to the controversy, the Mayor and his followers in favor of the plan and the Detroit United Railway officials who oppose it are taking advantage of all possible opportunities to express their views to the taxpayers.

Campaigning Begun

Either the Mayor or his adherents in the matter are appearing daily before different organizations to discuss the issue and clear up points of doubt in the minds of the car riders who will decide the question on April 5.

The Detroit United Railway officials are endeavoring to justify the company's conduct in the matter of providing extensions by reviewing conditions as they have existed in the past years. The company's views are being expressed through its official weekly publication and by paid advertisements in the local papers.

The greatest organized opposition to the municipal ownership plan was expressed at a meeting of the street railway men's union, Division No. 26 of the Amalgamated Association, when a resolution was adopted denouncing the Mayor's plan as a piece-meal experiment sure to result in a useless duplication of equipment, shops and machinery, and "in confusion and inconvenience to the car riders rather than improvement and relief." The declaration was made by the railway men that the service-at-cost plan will solve the problem if properly put into operation.

The proposed bond issue for piece-meal construction is opposed as a waste of time and funds and the entire membership of the organization will be called upon to oppose the Mayor's proposition and to work for its defeat until the date set for voting upon the question.

The Detroit United Railway maintains that it has built in the city of Detroit every foot of railway tracks that the city authorities would allow it to build and when restrained from building in the city, went outside the city and by outside authority built many miles of railways later included in the city and one-fare zone when the city limits were extended.

Company Returns to the Attack

Admitting that the city is short on railway service and reviewing past circumstances including the World War, instructions from city authorities to avoid construction in Detroit pending the popular vote on municipal ownership in 1915, and similar conditions in 1919 when another like vote was taken, the company maintains that it is unfair for those who have prevented it from extending service to now make inadequate service the sole basis of attack.

In discussing the bond issue the company's publicity department points out that Detroit's municipal pot is shy in many ways, including schools, watermains, municipal lighting plant, police department, and even jails.

The cost of construction of the proposed piece-meal system, if approved by the city, will not come out of the taxes, as all construction costs will be met by the sale of bonds issued against the faith and credit of the city itself. The city charter provides that "the faith, credit and property of the city of Detroit shall remain pledged for final payment of all bonds issued and of all moneys borrowed by authority of, and in accordance with this charter or any act of the legislature of this state."

If, however, by any chance or under any circumstances enough money does not come in from railway operation, resulting in deficits, even though the fares were boosted again and again, the bonds will be paid because they are bonds upon the entire city and taxpayers' money is used to pay bonds.

Commenting favorably upon the Mayor's plan, and branding the claims of the railway as false, the supporters of the plan advanced no argument with the man constitutionally opposed to municipal ownership as long as his opposition is based upon facts. The four-to-one vote in favor of the municipal ownership charter proves these opponents are a small minority.

Why Previous Plans Failed

One objection to previous settlement plans was that more service was not provided. The present plan is supremely a service-at-cost plan providing 100 miles of new tracks and 550 new cars at once.

The Mayor's plan involves no contracts with the Detroit United Railway, thus eliminating objections of those who feared the expense and trouble which would come from entering into contracts with the private company. As it is intended to take advantage of the right the Supreme Court gave the city to oust the railway from Fort and other streets where franchises have expired, another objection to previous settlement plans has been met.

The fourth objection was to the purchase of the Detroit United Railway's equipment at a price either too high or not definitely determined. This objection is met by the present plan inasmuch as the purchase of new cars and equipment will make the purchase of the company's cars unnecessary.

Meeting the objection that municipal ownership is not efficient, that it does not give service, city officials state that in the last ten years municipal authorities have increased sewerage systems 50 per cent, increased mileage of paved streets by 80 per cent, increased mileage of watermains by 90 per cent, all at the cost of construction while in these ten years when the population of the city has increased more than 100 per cent the Detroit United Railway has increased its service a meager 25 per cent.

It is also maintained that the city can borrow money to build and equip 155 miles of new trackage at 4½ per cent or 5 per cent where the Detroit United Railway would have to pay 10½ per cent to get the money to build similar lines, thus providing a saving annually of $900,000 in interest charges alone.

Mayor Couzens has sounded the warning that if the proposed plan does not go through it will be years before the much needed car line extensions, some 200 miles in extent, can be built and that they may never be built. A private company cannot build the needed extensions without a vote of the people. Either a vote is required or the lines must be built on a day-to-day agreement and the company says it cannot finance a day-to-day agreement.

Mayor Sounds Warning

Detroit can expand only if it gives proper transportation to its workmen. Something must be done to remedy present traffic conditions and the Mayor's claim is that Detroit will not get anywhere by relying on private capital while his proposed plan means development and progress for the city. He has also sounded the warning that only four out of every ten voters need vote against the plan to kill it.

Seeks to Reduce Paving Cost

An agreement has been reached by the San Diego (Cal.) Electric Railway, the City Council of San Diego and the California Railroad Commission to permit the railway to try out a crushed rock paving on streets where traffic is not as heavy as in the business district of the city.

According to specifications submitted by the railway company's engineers, the new paving is to consist of a layer of coarse crushed rock, with a surface of finely crushed rock, but no cement is to be used with it as a binder. Concrete curbs will be laid to hold the paving in place.

Reed Dilworth, general counsel for the railway company, stated at the conference that it was impossible for the company to put down the regular asphalt pavement because of financial conditions at this time.

Engineer Sachse of the Railroad Commission stated that a pavement similar to that proposed to be used in San Diego was put down between the tracks of the "Key Route" between Oakland and Richmond.

Engineer A. Ervast of the San Diego Electric Railway refused to give out for publication any figures as to the relative cost of the proposed paving, saying that such figures would be available only after an experimental section had been put down.

Commissioner Paints a Drab Picture

Legislature Hears That More Than One-Third New York City Mileage Is in Hands of Receiver

Lewis Nixon, Public Service Commissioner for the First District, of New York on March 2 submitted a special report to the Legislature upon the traction situation in New York City in response to a concurrent resolution passed in January. The report is in a pamphlet of seventy-seven pages, which are summarized in certain general conclusions.

Subway Alone Profitable

Mr. Nixon holds that the Interborough subway if operated alone can very probably survive under the present rate of fare, but that the Interborough system, including the Manhattan Elevated line, can avoid a receivership only by a subordination of the investment interest charges or through securing additional revenue.

Mr. Nixon also holds that it is doubtful if the New York Consolidated Railroad which operates certain city subways in connection with the Brooklyn Elevated road, can continue at the present rate of fare under existing contracts and pay interest on municipal and company bonds. As to the surface lines, both those in Manhatttan and other boroughs, he expresses the view that they must either have more revenue or that their deterioration, disintegration and further suspension of service may be expected to continue.

The commissioner suggests a plan of reorganization of all the companies into one company for the entire city, or, if that is not possible, one large company with a single management in the area now served by the Interborough Rapid Transit Company, and one for the area served by the Brooklyn Rapid Transit Company. He says a simple increase of fare without corresponding concessions from the companies should not be considered under any circumstances. Perpetual franchises for surface lines should be abolished and a proper form of indeterminate franchise substituted. The securities should be refunded and based in amounts upon a fair appraisal of the properties and amortization should be provided to vest title in the city after a certain term of years. A flexible cost-of-service fare should be established, controlled by a surplus fund and consideration should be given to the remission of taxes and paving charges, because all expenditures are reflected in the fares charged.

Suggests Experiment With Fares at Cost

The commissioner suggests the tentative establishment for six months of such a cost-of-service fare, the receipts from which should be used only for cost of operation and maintenance, and not one cent for dividends of any nature. Accounts should be kept of receipts and expenditures for the first four months and these subjected to an analysis to be completed within the six months, after which time the fare for the next six months could be determined.

Mr. Nixon says the reorganization plan should include the modification of the dual subway contracts. The provisions for preferential payments to the companies under these contracts should be opened and a fair adjustment made after full investigation. The revenues from a cost-of-service fare on rapid transit lines should be sufficient to meet the contract requirements for the payment of interest and sinking fund on the city's rapid transit bonds, or at least on a substantial portion of them, so that they may be relieved from the operation of the debt limit.

After explaining the different methods of ownership of the various lines, the report reads:

> As the result of corporate extravagance in the past and municipal inaction, the city of New York is now reaping a whirlwind in transportation shortage, bankruptcy of companies, disintegration of long-established and efficient systems into less effective units, double and in some cases triple fares resulting therefrom, the absolute stoppage of several important lines, and the ever-present threat of further demoralization and bankruptcy.
>
> The consequences of this policy of inaction may be seen today in the deplorable conditions existing, of which the following is a summary:
>
> Street railroad trackage abandoned and service discontinued, 77.82 miles.
>
> Street railroad trackage cut off from parent systems and now operated separately under additional fare, 266.22 miles.
>
> Nine operating companies in the hands of receivers, representing a total of nearly 700 miles of track—more than one-third of the total trackage in the city. (Two of these receiverships, namely, the Second Avenue and the Manhattan and Queens companies, with 44 miles of track, antedate 1918.)
>
> Combined deficits of street railroad companies for the fiscal year ended June 30, 1919, $8,083,820, which shows the companies worse off by $13,350,346 than the year before.
>
> Deferred maintenance already amounting to $6,000,000, and consequently growing, which will have to be made up if the property is to be kept in condition.
>
> About 1,575 free transfer points abolished, 1,500 in Brooklyn and 75 in Manhattan.
>
> Tremendous shrinkage in values of street railroad securities, entailing heavy losses to investors.
>
> The companies' distress is the city's opportunity. They will, they must make concessions to the city in return for permission to raise rates, and if the municipal authorities would enter into negotiations to that end I feel confident that the situation can be saved with satisfaction to the carriers and with profit to the city.

The report says that if the Manhattan Elevated Railway still serves to drag the Interborough down the latter may fall into the hands of a receiver in June.

P. R. T. Accomplishments Reviewed

Relations Between Philadelphia Rapid Transit Company and Its Employees Described in Year Book

The record of accomplishment of half a decade of co-operative management is summed up in the 1919 Year Book of the Co-operative Welfare Association of the Philadelphia (Pa.) Rapid Transit Company. The book, which was published recently, is a profusely illustrated pamphlet, and in its forty-odd pages one catches a glimpse of the "Philadelphia plan" in action.

Features of Plan Well Known

The essential features of this "Philadelphia Plan" are too-well known to make their repetition necessary beyond a bare outline. The scheme was worked out by Thomas E. Mitten shortly after he became president of the Philadelphia Rapid Transit Company. Briefly, it provides for settlement of wage and other disputes between company and men through an employees' organization, the Co-operative Welfare Association. Wages are regulated by the average pay for the same kind of work prevailing in four other cities.

The 1919 Year Book contains the minutes of the association's annual mid-winter meeting and the speeches made at the president's dinner on Sept. 4 last and at the association's picnic and "get-together" meeting, held on Sept. 3 and 4. At the mid-winter meeting, held on Dec. 27, 1919, the officers of the association and the committee chairmen submitted their reports. George W. Jackel, president of the association, announced that the membership included more than 99 per cent of the company's employees.

The beneficial results which the organization has accomplished in the direction of stimulating good will between the company and the public, are well brought out in the talks of prominent Pennsylvanians who addressed the meeting. W. D. B. Ainey, chairman of the State Public Service Commission, said, speaking of service-at-cost:

> But there is one fundamental weakness in all these plans, which leads me to say to you, that you have gone a step further than any other plan that I have heard of, or seen, in the solving of street railway problems, and that is, you have, by your plan of co-operation, solved all the points of difference that sometimes come up between management and labor.
>
> Coming down on the train this morning from Harrisburg, discussing street railway problems casually with a gentleman with whom I was sitting, we adverted to your Philadelphian Plan. I am going to tell you that I made this remark, that the focal point which has lifted the P. R. T. system above many others of the country, is the work that you gentlemen of these committees have done in your co-operative efforts to make the management a success.
>
> So I, as a member of the Public Service Commission, interested in the success of all the utilities, am very proud of your efforts, because you are enabling this company to serve this locality and be the kind of a carrier and public service body that the Commission at Harrisburg is anxious to see engaged in all lines.

Hon. Samuel M. Clement, Jr., Commissioner, Public Service Commission of Pennsylvania, said in part:

> I want to say to this audience that Governor Sproul, Mayor Moore, City Solicitor Smyth, and every other prominent man in this room today—real, full-blooded Philadelphians—all are mighty proud that there is one organization in the United States where labor and capital can get together and work for the welfare of humanity as you men are doing. You are doing a wonderful work, and there is not a Bolshevist in the audience—not one. If you keep up the work that you have done,

Philadelphia will have something to be proud of. I do not care so much about the rate of fare—I care more about the contentment and the happiness of the people of Philadelphia that you represent.

Mayor-elect J. Hampton Moore of Philadelphia, said:

I have witnessed here today in the few brief moments that I have been in this hall a picture which I shall not forget. It is so different from some of the pictures I have seen in days gone by in the City of Philadelphia. How many of you recall the early strike troubles, way back in 1888 and 1889, when the men, finding they could not exist decently upon the wages paid, when they were receiving less than 20 cents an hour, finally determined upon the force of the strike to obtain what they claimed at that time was justice? I remember those days, the cars tied up, men out all over the city, and finally, under the benign influence of the compromise and the conference, going back with better pay. We can decently contrast that condition, less than 20 cents an hour, with the rather remarkable statement made by Mr. Mitten today, that the maximum rate is 58 cents an hour, a percentage of increase that is a great credit to the officers and management of this company. That explains why, instead of having Bolsheviks, anarchists and rioters in the City of Philadelphia, we have now a peaceful co-operation, between the traction company and its 10,000 employees, that is a model for the rest of the country.

Governor William C. Sproul of Pennsylvania was also among the speakers. He paid a tribute to the association's work in these words:

I am glad to have an opportunity of testifying to the appreciation we have of the good effect that this plan is having on the rest of the State.

I know a great many of the men who work on the cars here in Philadelphia, went to school with a good many of them and see them every once in a while. Let me say that they are better qualified, better appearing, better looking generally, and more courteous and attentive, than any people that I know of anywhere in service in the other cities of the country.

Arbitration Agreement in Atlanta

An agreement for 1920 has been reached between the Georgia Railway & Power Company, Atlanta, Ga., and a committee representing the railway union. Every point at issue is covered in the agreement except the question of hourly wages. This question will be submitted to arbitration. Luther Rosser will represent the company and Madison Bell the union. A third member of the board of arbitration will be chosen by these two.

Preston S. Arkwright, president of the company, would not give out the details of the contract. He stated, however, that the "closed shop" is not included in the new agreement. All matters referring to the relations of the members of the union to the company and the operation of the company's cars in Fulton, DeKalb and Cobb counties were fully agreed upon by both parties, with the exception of the straight hourly wage.

On Feb. 26 Mr. Bell submitted the name of Mayor James L. Key as the third member of the board of arbitration to act as umpire, but Mr. Rosser declined to accept him. This resulted in the employees calling a mass meeting on the night of Feb. 27 which was attended by more than 1,000 union men, most of them railway employees. At 3:00 a.m. on Feb. 28 a motion to strike was presented at the meeting, but the appeals of the executive committeemen had the desired effect and the men finally agreed to let the matter rest until an umpire is named and board of arbitration can meet to settle the wage matters.

Mr. Rosser refused to accept Mayor Key as umpire because the Mayor has been more or less hostile to the company in the past.

City Threatens to Seize Railway

Corporation Counsel Burr of New York announced on March 4 that unless the Interborough Rapid Transit Company improved its service greatly on the subway lines within ninety days steps would be taken for the seizure and operation of the property by the city. The announcement followed instructions to Mr. Burr by the Board of Estimate on March 3 to take action to deprive the New York Railways of its franchises for failing to furnish adequate service.

In reference to the subway lines, Mr. Burr said he would call upon the Public Service Commission and insist that the terms of the Interborough Company's contract with the city be lived up to. He explained that a clause in the dual subway contract provides that the Interborough Company shall furnish adequate service, and that if it fails to do so, and the warning of the city is disregarded for ninety days, the city could take over the lines and either operate them itself or turn them over to an operating agency.

On March 1 Public Service Commissioner Lewis Nixon issued an order directing the Interborough Company to add 600 more cars to its subway service not later than March 10. The order practically provides for a service equal to the present rush-hour periods during the entire day. Mr. Burr, in his statement, referred to this order by Mr. Nixon as follows:

There is ample proof of the inadequacy of the present service and unless the 600 additional cars are provided the present serious congestion will continue. At present there appears to be no doubt that the contract with the city has been violated. Recent hearings have proved this beyond a doubt.

Thirty Lines Still Tied Up

Surface railway lines in three boroughs of Greater New York were still out of commission on March 3 through the blizzard responsible for their break-down begun four weeks ago. The following lines, thirty in number, are still idle:

NEW YORK RAILWAYS—Eighty-sixth Street and Spring Street.

THIRD AVENUE—West Side belt; Avenue B, from Fourteenth to Fifty-ninth Streets.

SECOND AVENUE—Second Avenue, Canal to Worth Streets; First Avenue shuttle.

EIGHTH AND NINTH AVENUE—Ninth Avenue, Eighth Avenue, from 116th to 125th Streets.

B. R. T. AND BROOKLYN CITY—Montague Street; Metropolitan Avenue, from Dry Harbor road to Jamaica Avenue; Wykoff Avenue; Avenue C, one track; Bergen Beach, one track; Flatbush Avenue shuttle; Holy Cross shuttle; Nostrand Avenue shuttle, one track; Ocean Avenue, one track; Utica Avenue shuttle; Ralph Avenue shuttle; Canarsie shuttle, Avenue K to Canarsie; Grand Street, Metropolitan Avenue to Fresh Pond Road and Jackson Avenue to North Beach.

NEW YORK & QUEENS COUNTY—Calvary Cemetary, Lutheran Cemetary to point one-fourth mile west; Steinway, Riker Avenue to North Beach; Corona, Fisk Avenue, Woodside, to Leona Avenue, Corona; Flushing Avenue, Second Avenue to North Beach; Vernon Avenue, one track; Fourteenth Street to Broadway; Dutch Kills, entire line.

LONG ISLAND ELECTRIC—Hollis to Belmont Park.

NEW YORK & LONG ISLAND—Hempstead to Jamaica and Mineola to Jamaica.

Bank Comments on Electrification Prospects

Fuel saving and increased track capacity would be two of the important results from the electrification of the railroads of the country, it is stated by the National Bank of Commerce in New York in the March issue of its magazine, *Commerce Monthly*.. However, chiefly because of the great expense involved in the transition from steam to electrically operated railroads, it is unlikely that any general move toward electrification will be made in the near future. The bank says:

It would not be without precedent if the next decade witnessed England and the continent outstripping this country in the exploitation of another industry which, while possibly not conceived here, has certainly been more fully developed in America than elsewhere.

It is plain that we must take a long-sighted view of the future of our railroads. They must be given such freedom to develop and to improve their facilities that they will not be required to enlarge their facilities merely on the basis of the immediate pinch, but will be able to introduce improvements from the standpoint of return a decade or two decades hence. Electrification thus has its greatest argument in the future, for with the rapidly increasing cost of fuel and rate of traffic, the ultimate return on any amount now invested in electrification will be more than generous compared with the return on the accumulated amount which might be spent year by year over a long period in patching up our steam railway system.

Traffic on our railroads normally doubles every twelve years. Practically all improvements have been postponed for a long period. When the process of rehabilitation begins, it will be well to consider devoting to electrification part of the tremendous sum which will have to be spent

The magazine points out that it is estimated that $2,500,000,000 must be spent in the next three years to meet the accumulated and the current annual need for improvements. It then cites the fact that plans for future electrification are more extensive abroad than at home. It says:

Conditions in the United States are not favorable for putting into effect any extensive scheme for electrification. The political and economic situation of the American railroads is at best uncertain. Without going into the effect of governmental regulation on the railroads during the past few years, it is fairly evident that capital is not seeking railroad investment. Also, the fuel situation in the United States is so much more favorable than is that of most other nations that the problem of conservation and efficient utilization of our coal supply has not become so acute as in Europe

Mr. Beeler in Chicago

John A. Beeler has been employed by Henry A. Blair to study the routes, schedules and equipment of the Chicago Surface Lines and to make such recommendations for improvements as he finds advantageous.

News Notes

Two-Cent Wage Advance at Covington.—The Cincinnati, Newport & Covington Railway, Covington, Ky., has granted its carmen an increase in wages of 2 cents an hour. Under the new scale the maximum rates are raised to 45 cents and 50 cents an hour.

Appeal for Wage Increase.—The employees of the Joplin & Pittsburg Railway, Pittsburg, Kan., have filed a complaint with the Kansas Industrial Court asking for increased wages and better working hours and conditions on that line. The employees were awarded a raise in wages by the War Labor Board, but it is said that the increase was never placed in effect.

Jury Inquiry in Richmond.—The Richmond County Grand Jury has been instructed to investigate all the circumstances attending the suspension of service by the Staten Island Midland Railway, which ceased operation after its failure to make the city officials of New York realize the need of the company for increased fares. Residents of Staten Island, deprived of car service, have indicated their willingness to pay a 10-cent fare if necessary.

Governor Vetoes Fare Bill.—Governor James M. Cox, of Ohio denied to the State Public Utilities Commission the right to interfere with the Toledo railway situation by fixing of rates for two years, when he vetoed the bill presented by Representative Evans of Lucas County, after it had passed both houses of the Assembly with little or no general debate. The bill gave to the commission the power of rate determination of city tractions such as it has in the case of other utilities and interurbans at the present time.

An Echo of the Past.—Municipal ownership, once so strongly advocated by the Mayor of Atlanta, Ga., has never received the smallest encouragement from the taxpayers. Since the State Legislature of Georgia a year ago turned down a proposition looking toward municipal ownership, little if anything has been heard on the subject. It is not regarded as probable that a municipal ownership program, which has been discussed in some sections of the State, will find any favor with the law makers at the June session of the Legislature.

Explains Service-at-Cost.—Harry Reid, president of the Kentucky Utilities Company, the Louisville & Southern Indiana Traction Company, the Louisville & Northern Railway and the road between Louisville and Indianapolis, explained the service-at-cost plan of operation in an interview in one of the Louisville papers recently. Mr. Reid is a resident of that city. He said that he did not care to be placed in the attitude of giving advice either to the city authorities or to the new administrative body of the Louisville Railway, but merely was pointing out at the request of the paper how the system had worked out satisfactorily in other cities.

Suggestions Welcome.—Believing that the men on the job, who are in very close touch with conditions, can offer suggestions to the officials of the Monongahela Valley Traction Company, Fairmont, W. Va., that will improve service and better conditions in general, George M. Alexander, president of that corporation, is going to make an effort to avail himself of these suggestions. Compensation of an adequate nature will be offered for those that are accepted. All suggestions will receive the earnest consideration which is due them. A committee has been appointed to devise means and a system of compensation for such suggestions.

Municipal Railway an Election Issue.—It is expected that the election in Seattle, Wash., on March 5 will bring about a change of administration in city affairs, as both Hugh M. Caldwell, former corporation counsel, and James A. Duncan, the labor candidate, defeated the present Mayor at the primaries. Mr. Caldwell, who will very probably be elected, has expressed himself as bitterly opposed to the municipal railway management, and in fact the entire project. He has even intimated that he will, if elected, take steps to revoke the $15,000,000 deal whereby the city took over the railway lines of the Puget Sound Traction, Light & Power Company.

City Commission Against One-Man Cars.—The City Commission of Nashville, Tenn., has passed on third and final reading an ordinance abolishing one-man cars in that city. The Mayor and Commissioner Tompkins voted against the proposal. The measure becomes effective in ninety days. The Nashville Railway & Light Company has invested $150,000 in one-man cars. It protested the passage of the measure abolishing the cars. Representatives of local schools and colleges and of local manufacturing companies appeared in opposition to the bill. For the company, Walter Jackson explained the operation of the cars and reviewed their history and development. He called particular attention to the fact that one-man cars originated in and enjoyed the greatest popularity in the South.

Snow Affects Connecticut Trolleys.—While other electric railways in New England temporarily abandoned large portions of their systems during the recent series of severe snowstorms, the Connecticut Company at no time failed to provide some sort of service on all parts of its system and kept schedules even during the most trying days of the period on 85 per cent of its lines. On March 1 the company was able to announce 100 per cent service on all lines. The Hartford & Springfield Street Railway, which operates on both banks of the Connecticut River between the two cities, had its first through service in more than a week on the east side on March 1, and hoped to get back to normal on the west side during the week. The Shore Line Electric Railway has had intermittent service on its lines during the storms.

To Close North Hampton Branch.—The New Hampshire Public Service Commission on Feb. 24 gave the Portsmouth Electric Railway authority to suspend traffic on its North Hampton branch, connecting the town of North Hampton with Hampton Beach, unless an agreement between town and company is reached before May 1. Authority to close for the time being the North Beach branch was refused, as rail communication between Portsmouth and Hampton Beach would thereby be severed. The company will not be required this winter, however, to clear out about 200 yards of ice-filled tracks, so that transfer of passengers will temporarily be necessary at that point.

Program of Meeting

Central Electric Railway Association

The program of papers has been announced for the annual meeting of the Central Electric Railway Association at the Seelbach Hotel, Louisville, Ky., on March 10 and 11. Sessions will be held at 2 p.m. on March 10 and 9 a.m. on March 11. The dinner for association members, their families and invited guests will be at 7 p.m., on March 10. The executive committee will meet at 9 a.m., on March 10. The Interstate Public Service Company has arranged to furnish a special car to be operated between Indianapolis, Ind., and Louisville, Ky., on March 9.

The session on March 10 will be opened with the annual address by J. F. Collins, president of the association. This will be followed by the business session and the reading of reports of committees. Ralph H. Rice, principal assistant engineer, Board of Supervising Engineers, Chicago Traction, will then read a paper "Rail Bonding." The discussion will be participated in by M. B. Lambert, assistant manager of the railway department of the Westinghouse Electric & Manufacturing Company; Ralph W. Palmer, engineer with the General Electric Company; E. W. Rowland, bond engineer with the Ohio Brass Company; R. J. Custer, engineer of ways and structures of the Interstate Public Service Company.

Following the business session on March 11 there will be a paper by D. D. Ewing, professor of electric railway engineering at Purdue University, "Economical Use of Electricity for Car Purposes." The discussion of this paper will be led by L. E. Gould, president of the Economy Electric Devices Company, and by L. M. Clark of the Railway Improvement Company.

The regular session will close with the presentation of the annual report of the secretary and treasurer and the election and installation of officers for the ensuing year.

Financial and Corporate

Increase in Revenue for November

Fare Increases, One-Man Cars and Absence of Epidemic Lead to More Favorable Conditions

A comparison of returns for the month of November, 1919, with those for the same month in 1918 of those companies reporting their operating statistics to the information bureau of the American Electric Railway Association, shows results quite favorable to 1919. This is probably due, in part at least, to the effect of the influenza epidemic, which although it had passed its climax at the end of October, 1918, in the East and South still lingered with enough force to make itself felt in those sections of the country throughout the month of November.

NOVEMBER WORST IN WEST

In the West, the disease did not reach its full malevolence until after it had been gotten well under control in the other sections of the country. November was probably the worst month in the West, and this is very clearly reflected in the attached tables in which the West makes the most favorable showing in the comparison of 1919 with 1918.

The South seems to be enjoying an unusual degree of prosperity which has shown up consistently in its operating statistics for the last few months. Several factors are contributing to this prosperity, or at any rate are contributing to the favorable showing made in the latter months of 1919 when compared with the corresponding months of 1918. First there are the lingering effects of the influenza mentioned above. Second, there are the numerous oil booms occurring there, bringing in their train large additions to the population and building up the traffic of the local street railways. Third, there is the introduction of one-man cars during 1919 on a large proportion of the mileage represented in the accompanying tables, with the consequent reduction of expenses and tendency to secure the maximum amount of traffic possible.

TABLES ANALYZED

In Tables III and IV an analysis of the operating expenses is given, Table III showing the actual amount spent by the different departments and Table IV showing the same amounts on a per car-mile basis.

A study of these tables shows that the heaviest increases have occurred in the way department, with the transportation department second. For the country as a whole the cost of maintaining way and structures rose from 2.7 cents per car-mile in November, 1918, to 4.24 cents per car-mile in November, 1919, an increase of 57.03 per cent. The heaviest increase in this department occurred in the West, where it jumped from 1.81 cents per car-mile in 1918 to 5.11 cents per car-mile in 1919, or 182.32 per cent.

The cost of conducting transportation for the country as a whole increased 25.54 per cent per car-mile, rising from 11.08 cents per car-mile in 1918 to 13.91 cents in 1919. The West showed the heaviest increase in this department also, the increase being 33.23 per cent per car-mile.

The only item of expense showing an actual decrease in any part of the country was that for power. In the East the cost of power dropped from 6.2 cents per car-mile in 1918 to 5.83 cents in 1919, a decrease of 5.97 per cent per car-mile. The South also showed a slight decrease in power expense, amounting to 0.71 per cent per car-mile, but as some of the Southern companies include their power expenses in their expenses for conducting transportation, the figures for these items are probably not strictly accurate.

USUAL TERRITORIAL ARRANGEMENT FOLLOWED

As in the past the returns from both city and interurban companies have been classified according to the following geographic grouping: Eastern district—east of the Mississippi River and north of the Ohio River; Southern district—south of the Ohio River and east of the Mississippi River; Western district—west of the Mississippi River.

Boston Has Fairly Good January

The financial statement of the month of January as given out by the Boston (Mass.) Elevated Railway shows a net gain of $99,727 as compare dwith $343,333 for the proceeding month. The difference is due mainly to the fact that the month of January was a particularly stormy one. The total receipts for the month were $2,868,841. The total cost of service was $2,769,113. The total operating expenses were $2,071,950, of which $1,373,223, was for wages. During the month there were 28,467,646 revenue passengers and the cost of service per passenger was 9.727 cents. The receipts per revenue passenger amounted to 10.078 cents. Due to the particularly favorable balance now resulting from the 10-cent fare, it is very likely that the end of the year 1920 will find the Boston Elevated Railway able to continue its programme without the necessity of resorting to special assessments upon the cities and towns served.

Connecticut Loss $177,110

Increased Revenues Under Zone Plan Offset by Mounting Expenses — Figures for Three Months

The Connecticut Company went $177,110 behind in the first three months of operation under the zone system, despite greatly increased gross revenues. This was learned at the final hearing on the zone system before the Public Utilities Commission in the State capitol at Hartford, Conn.

Greatly increased costs of operation were responsible for this condition, according to President Lucius S. Storrs, who said that a statement on the situation would be issued by the company shortly. He and Walter J. Flickinger, his assistant, expressed the belief that under the 6-cent system, in force up to Nov. 2 of last year, the loss would have been much greater. In the year ended October 31, 1919, the company had a deficit of little more than $10,000.

In each month since the establishment of the zone system the company's gross revenue has shown an increase over that of the corresponding month in the preceding year. February was a banner month so far as gross receipts were concerned, but the great expense of keeping the lines open during the series of storms that has swept Connecticut has eaten into this increased revenue and sometimes more than nullified it.

During November, the first month of the zone system, the deficit of the company after taking out the amount required for fixed charges was $82,999. In December the deficit was only $110 because of the great volume of holiday season riding. The January deficit was $94,000. During February, with a large number of snow storms that kept the jitneys off the streets, the volume of riding was approximatly 25 per cent greater than that in the same period of 1919, but the work of keeping the lines clear was very expensive.

Attorneys for most of the sixteen towns protesting against the zone system were heard in final argument. Joseph F. Berry, attorney for the company, told the commission that under the law he did not believe that body had the power to set rates for passenger service and then grant a lower rate for commuters.

The commission intimated that its decision would be given early in April.

Court Orders Service Discontinued

Judge Mayer in the Federal Court at New York on Feb. 27 authorized Job E. Hedges, receiver of the New York, N. Y., to discontinue the operation of the Seventh Avenue line and of the Fourteenth Street line across the Williamsburg Bridge. The date for the discontinuance was set for March 7. The order was made on the grounds that the company has no franchise for service over the bridge. The franchise is owned by the Fourth and Madison Avenue line, which was recently separated from the rest of the New York Railways.

TABLE I—INCOME STATEMENT OF THIRTY-THREE RAILWAYS FOR NOVEMBER, 1919, COMPARED WITH NOVEMBER, 1918

	United States		East		South		West	
	1919	1918	1919	1918	1919	1918	1919	1918
Railway operating revenues	$6,444,246	$5,385,969	$3,154,686	$2,692,601	$694,614	$601,193	$2,594,946	$2,092,175
Railway operating expenses	4,969,084	4,177,439	2,521,970	2,104,827	472,429	416,510	1,974,685	1,656,102
Net operating revenue	1,475,162	1,208,530	632,716	587,774	222,185	184,683	620,261	436,073
Net revenue: Auxiliary operations	62,071		50,369		4,272		7,430	
Taxes	374,974	340,839	168,560	173,125	57,537	53,059	148,877	114,655
Operating income	1,162,258	867,691	514,525	414,649	168,919	131,624	478,814	321,418
Non-operating income	141,854	103,325	79,527	50,326	172	6,642	62,155	46,357
Gross income	1,304,112	971,016	594,052	464,975	169,091	138,266	540,969	367,775
Deductions from gross income	1,207,560	1,135,052	554,946	487,358	128,227	128,664	524,387	519,030
Net income	96,552	*164,036*	39,106	*22,383*	40,864	9,602	16,582	*151,256*
Operating ratio (per cent)	77 09	77.58	79.91	78.19	68.01	69 27	76.11	79 17
Car miles operated	16,696,655	16,033,000	7,938,985	7,501,534	2,027,162	1,919,772	6,730,508	6,611,694

TABLE II—INCOME STATEMENT IN CENTS PER CAR-MILE OF THIRTY-THREE RAILWAYS APPEARING IN TABLE I, COMPARING NOVEMBER, 1919, WITH NOVEMBER, 1918

	United States			East			South			West		
	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase
Railway operating revenues	38.60	33.59	11 49	39 74	35.89	10.73	34.26	31.31	9.42	38.55	31.64	21.83
Railway operating expenses	29.76	26.06	11.42	31.76	28.06	13.19	23.30	21.69	7.42	29.34	25.05	17.12
Net operating revenue	8.84	7.53	11.74	7.98	7.83	1.91	10.96	9.62	13.92	9.21	6.59	39.75
Net revenue: Auxiliary operations	0 37			0.63			0.21			0 11		
Taxes	2 25	2.13	5 63	2.12	2.31	*8 23*	2.84	2.76	2.90	2.21	1.73	27.74
Operating income	6 96	5.40	28.88	6.49	5.52	17 57	8.33	6 86	21.42	7.11	4.86	46.29
Non-operating income	0 84	0.64	31.25	1 00	0.67	49.25		0.35		0.92	0 70	31.43
Gross income	7 80	6.04	29.13	7.49	6.19	21.00	8.33	7.21	15.53	8.03	5.56	44 42
Deductions from gross income	7 23	7.07	2.26	6 99	6.50	7.54	6.32	6.70	*5.68*	7.79	7.85	0.77
Net income	0.57	*1 02*		0 50	*0 81*		2.01	0.51	*294.41*	0.24	*2 20*	
Operating ratio (per cent)	77.09	77.58	*0 64*	79 91	78.19	2.19	68.01	69.27	*1 82*	76 11	79.17	*3 87*
Car miles operated	16,696,655	16,033,000	4.14	7,938,985	7,501,534	5.83	2,027,162	1,919,772	5.59	6,730,508	6,611,694	1.79

TABLE III—OPERATING EXPENSES OF THIRTY-SEVEN RAILWAYS FOR NOVEMBER, 1919, COMPARED WITH NOVEMBER, 1918

	United States		East		South		West	
	1919	1918	1919	1918	1919	1918	1919	1918
Operating expenses	$5,557,217	[1] $4,498,566	$2,744,480	[2] $2,346,890	$640,205	$531,148	$2,122,532	[3] $1,620,528
Way and structures	783,522	476,091	377,238	301,600	62,100	55,088	344,184	119,403
Equipment	610,645	528,287	301,637	286,276	74,338	59,980	234,670	182,031
Power	867,669	814,348	507,470	511,539	42,624	39,425	317,575	263,384
Conducting transportation	2,571,079	1,952,560	1,244,113	943,530	382,107	312,973	944,859	696,057
Traffic	21,703	21,814	10,837	9,585	753	464	10,113	11,765
General and miscellaneous	710,518	544,013	353,185	260,784	78,283	63,218	279,050	220,011
Transportation for investment—Cr.	*7,919*	*5,133*					*7,919*	*5,133*
Car-miles operated	18,473,777	17,642,446	8,699,238	8,250,087	3,044,031	2,780,665	6,730,508	6,611,694

NOTE—This table includes the expenses of the 33 companies shown in Tables I and II, and in addition 4 other companies which are not included in Tables I and II, because of the fact that they do a power and light business and do not separate their railway taxes and fixed charges from the taxes and fixed charges of their other business.

[1] Includes $166,576 undistributed depreciation and express and freight charges.
[2] Includes $33,576 for express and freight charges.
[3] Includes $133,000 undistributed depreciation.

TABLE IV—OPERATING EXPENSES IN CENTS PER CAR-MILE OF THIRTY-SEVEN COMPANIES APPEARING IN TABLE III, FOR NOVEMBER, 1919, COMPARED WITH NOVEMBER, 1918

	United States			East			South			West		
	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase
Operating expenses	30.08	[1]25.50	17.95	32.12	[2]28.45	12.90	21.03	19.10	10.11	31.54	[3]24.51	28.68
Way and structures	4.24	2.70	57.03	4.33	3.66	18.31	2.04	1.98	3.03	5 11	1.81	182.32
Equipment	3.31	2.99	10.70	3.47	3 47		2.45	2.16	13.52	3.49	2.75	26.91
Power	4.70	4.62	1.73	5.83	6 20	*5 97*	1 41	1 42	*0.71*	4.72	3.98	18.59
Conducting transportation	13.91	11.08	25.54	14.31	11.44	12.51	12.56	11.27	11.44	14.03	10.53	33.23
Traffic	0.12	0.12		0.12	0 12					0.15	0.17	*11.77*
General and miscellaneous	3.85	3.08	25.00	4.06	3.16	28.48	2.57	2.27	13.21	4.15	3.33	24.62
Transportation for investment—Cr.	*0.04*	*0.03*	33.33							*0.11*	*0.07*	57.00
Car-miles operated	18,473,777	17,642,446	4.71	8,699,238	8,250,087	5.44	3,044,031	2,780,665	9.47	6,730,508	6,611,694	1.79

[1] Includes 0.94 cents per car-mile undistributed depreciation and express and freight charges.
[2] Includes 0.40 cents per car-mile for express and freight charges.
[3] Includes 2.01 cents per car-mile undistributed depreciation.

TABLE V—COMBINED INCOME STATEMENT OF *EIGHTY-SEVEN RAILWAYS FOR NOVEMBER, 1919

	United States	East	South	West
Railway operating revenues	$16,375,134	$8,769,510	$1,260,016	$6,345,608
Railway operating expenses	12,581,356	6,862,456	879,121	4,839,779
Net operating revenue	3,793,778	1,907,054	380,895	1,505,829
Net revenue: Auxiliary operations	982,027	515,451	260,516	206,060
Taxes	1,002,991	486,347	122,228	394,416
Operating income	3,772,814	1,936,158	519,183	1,317,473
Non-operating income	374,918	139,936	4,098	230,884
Gross income	4,147,732	2,076,094	523,281	1,548,356
Deductions from gross income	3,212,633	1,714,698	310,752	1,187,183
Net income	935,099	361,396	212,529	361,173
Car-miles operated	40,407,387	21,657,136	3,676,591	15,073,657

* Includes the companies shown in Tables I to IV to others for which the 1918 figures are not available.

TABLE VI—COMBINED INCOME STATEMENT OF TABLE V, SHOWING THE AMOUNTS IN CENTS PER CAR-MILE

	United States	East	South	West
Railway operating revenues	40.52	40.49	34.27	42.10
Railway operating expenses	31.14	31.69	23.91	32.11
Net operating income	9.38	8.80	10.36	9 99
New revenue: Auxiliary operations	2.43	2.38	7.08	1.37
Taxes	2.48	2.24	3.32	2.62
Operating income	9.33	8.94	14.12	8.74
Non-operating income	0.93	0.65	0.11	1.53
Gross income	10.26	9.59	14.23	10.27
Deductions from gross income	7.95	7.92	8.45	7.88
Net income	2.31	1.67	5.78	2.39
Operating ratio (per cent)	76.85	78.27	69.77	76.27
Car-miles operated	40,407,387	21,657,136	3,676,594	15,073,657

TABLE VII—DETAILED STATEMENT OF THE OPERATING EXPENSES OF *ONE HUNDRED RAILWAYS FOR NOVEMBER, 1919

	United States	East	South	West
Operating expenses	[1]$12,685,330	[2]$7,093,579	$1,009,349	[3]$4,582,402
Way and structures	1,735,457	992,028	119,283	624,146
Equipment	1,420,394	848,307	30,058	542,029
Power	1,836,757	1,113,118	106,179	617,460
Conducting transportation	5,777,648	3,142,754	607,344	2,027,550
Traffic	47,717	25,429	2,466	19,822
General and miscellaneous	1,709,584	966,666	144,019	598,899
Transportation for investment—Cr.	*8,163*			*8,163*
Car-miles operated	42,782,633	22,693,813	4,743,721	15,345,099

* This table includes the expenses of the 87 companies shown in Tables V and VI and in addition 13 other companies which are not included in Tables V and VI because of the fact that they do a power and light business and do not separate their railway taxes and fixed charges from the taxes and fixed charges of their other business.

[1] Includes $165,936 undistributed depreciation.
[2] Includes $5,277 undistributed depreciation.
[3] Includes $160,659 undistributed depreciation.

TABLE VIII—DETAILED STATEMENT OF OPERATING EXPENSES OF THE ONE HUNDRED COMPANIES APPEARING IN TABLE VII, IN CENTS PER CAR-MILE

	United States	East	South	West
Operating expenses	[1] 29.65	[2] 31.26	21.28	[3] 29.86
Way and structures	4.06	4.37	2.51	4.08
Equipment	3.32	3.74	0.63	3.53
Power	4.29	4.90	2.24	4.02
Conducting transportation	13.50	13.86	12.81	13.22
Traffic	0.11	0.11	0.05	0.12
General and miscellaneous	4.00	4.26	3.04	3.90
Transportation for Investment—Cr.	*0.02*			*0.05*
Car-miles operated	42,782,633	22,693,813	4,743,721	15,345,099

[1] Includes 0.39 cents per car-mile undistributed depreciation.
[2] Includes 0.02 cents per car-mile undistributed depreciation.
[3] Includes 1.04 cents per car-mile undistributed depreciation.

Twin City Conditions Fair

Company Able to Meet Dividend Payments—Hopes Current Year Will Show Greater Improvement

The annual report for the year 1919 recently issued by the Twin City Rapid Transit Company, Minneapolis, Minn., indicates that the financial condition of the company has slightly improved and as yet the point has not been reached when it is necessary to pass the stock dividends entirely, although it is true that the dividend rate on the common stock has been below normal for the past two years.

An analysis of the accompanying table shows that operating expenses increased more than the revenues, due especially to large increases in the equipment, conducting transportation and general and miscellaneous accounts. The increase in these accounts resulted from the substantial increase in wages made to all employees on Aug. 20, 1919. The net income transferred to Profit and Loss for the year was slightly more than in the previous year,—thus making it possible to increase the dividend rate on the common stock by half of 1 per cent.

The increase in the track and equipment maintenance is also attributed to the continued increase in the cost of labor and material and the fact that during 1918 a large amount of maintenance work, especially as regards the equipment, had to be deferred because of the inability to secure sufficient labor to maintain the property in its past high physical condition of excellence.

Because the city claimed that the franchises of the company in Minneapolis expired in 1923, no track extensions or new rolling stock were added during the year. On Dec. 9, 1919, the voters in referendum refused to ratify an agreement resulting from four years' continuous and painstaking effort on the part of the company and Minneapolis city officials, providing for a service-at-cost franchise.

The company, although defeated for the time being in obtaining sufficient revenue to meet the ever increasing cost of service rendered, believes that an ultimate solution of the transportation problem in the Twin Cities will be worked out as the public more and more understands and appreciates that much of the prosperity of the community depends upon good transportation. The situation is rapidly adjusting itself to a point where the people are willing to pay a sufficient fare to insure adequate service and provide a reasonable return on the fair value of the property. Already the officials of the city of St. Paul are considering submitting to the voters of that city an amendment to the franchise ordinance under which service is now rendered, which will permit raising the fare from 5 cents to 7 cents. The company, however, in consideration of receiving this increase in unit rate of fare must furnish adequate equipment and service. Pending the outcome of this referendum, operation will continue and the best possible service rendered under the existing conditions.

To facilitate the handling of traffic and further economies of operation the company is planning to use a part of the renewal reserve fund for improvements in the equipment and the construction of certain extensions which it is hoped will somewhat reduce the congestion and thereby expedite traffic.

During the year an agreement was made with the Northwestern Terminal Company whereby that company financed an extension into a new industrial district. The notes covering the loan do not mature until the line is self-supporting and produces a return on the investment. The terminal company also guarantees the railway against operating losses.

INCOME STATEMENT OF THE TWIN CITY RAPID TRANSIT COMPANY

	1919	1918	Per Cent Change + Increase − Decrease
Revenue from transportation	$11,351,739	$9,618,501	+18 02
Revenue from other railway operations	90,705	77,479	+17 11
Total railway operating revenue	$11,442,444	$9,695,980	+18 02
Way and structures	$1,102,567	$1,005,629	+ 9.69
Equipment	1,245,070	823,048	+51.40
Power	1,175,293	1,132,335	+ 3 79
Conducting transportation	3,788,711	3,142,150	+20 58
Traffic	62,450	37,422	+66 80
General and miscellaneous	1,090,669	873,962	+24 82
Transportation for investment Cr	*19,701	*10,572	−86 40
Total railway operating expenses	$8,445,059	$7,003,974	+20 60
Net operating revenue	2,997,385	2,692,006	+11.33
Taxes assignable to railway operating	1,126,338	936,451	+20.25
Operating income	$1,871,047	$1,755,555	+ 6 08
Non-operating income	51,034	15,215	+235 50
Gross income	$1,922,081	$1,770,770	+ 8.05
Rent for leased roads	3,000	3,000	
Interest on funded debt	1,087,446	1,034,428	+ 5 13
Net loss miscellaneous physical property	32,829	27,334	+20 15
Miscellaneous debits	10,454	14,706	−28 92
Total deductions from gross income	$1,133,729	$1,079,468	+ 5.02
Net income transferred to profit and loss	$788,352	$691,302	+14 02

* Deficit.

STATISTICAL INFORMATION OF THE TWIN CITY RAPID TRANSIT COMPANY

	1919	1918	Per Cent Change + Increase − Decrease
Mileage—First track	243 07	243 03	...
Second track	177 40	176 80	+ 0 34
Total mileage—All tracks	452 65	451 50	+ 0.26
Average total miles operated	451 70		
Revenue passengers	222,186,823	188,930,268	+17 60
Transfer passengers	73,458,262	67,985,059	+ 8 06
Total passengers	295,645,085	256,915,327	+15 05
Gross passenger revenue	$11,179,535	...	...
Total per mile of line	46,000		
Total per mile of single track	24,750		
Average fare:			
Per revenue passenger (cents)	5 04		
Per total passenger (cents)	3 73		
Operating ratio (per cent)	73 7	72 2	
Taxes (per cent of gross revenue)	9 80	9 65	
Dividends paid			
7 per cent on preferred stock	210 000	210,000	
On common stock	2 5% 550 000	2% 440 000	

Abrogation of Lease Postponed

The Shore Line Electric Railway, which had planned to turn back to the Connecticut Company, New Haven, Conn., the New London and other lines operated under lease, will continue to run the lines indefinitely. This is in accordance with the wishes of the Connecticut Company. This permission was granted by Judge John P. Kellogg in the Superior Court in New London who passed an order approving of the extension of the agreement made by Robert W. Perkins, receiver of the Shore Line Electric Railway, with the Connecticut Company regarding the annulment of its lease of the local lines.

On Dec. 19 Mr. Perkins applied to the Superior Court for permission to annul the ninety-nine year lease of the New London lines with the Connecticut Company and the court passed an order terminating the lease and authorizing the delivery of the property to the Connecticut Company.

The application of Mr. Perkins stated that on account of the exigencies connected with the operation of its railway, the Connecticut Company finds it difficult and practically impossible to take over the operation of the leased lines and requested Mr. Perkins to continue the operation until one week after the Connecticut Company notifies the receiver that it is ready to take over the lines or until one week after the receiver notified the Connecticut Company of his unwillingness to continue further operation. Mr. Perkins states that it is for the best interest of the receivership estate and the public that the Shore Line continue the operation of the New London lines.

Spokane Sale Confirmed

The Federal Court at Tacoma, Wash., has approved the sale under foreclosure of the properties of the Spokane & Inland Empire Railroad, referred to previously in the ELECTRIC RAILWAY JOURNAL.

The Spokane & Eastern Railway & Power Company has accordingly taken over the former properties and holdings of the old company known as the Nine Mile power plant, and all transmission lines, all the city lines of the Spokane Traction Company, the interurban line extending east into the Spokane valley to Coeur d'Alene and Hayden Lake, the terminal properties in the city of Spokane, both passenger and freight, and the line extending into the Spokane valley known as the Vera line.

The other company, known as the Inland Empire Railroad, has taken over the property from a junction on Sprague Avenue in Spokane, extending south to Moscow and Colfax. Both companies will be officered and operated by the same individuals, who are as follows:

George H. Taylor, Chicago, president.

F. E. Connors, vice-president and general manager.

Waldo G. Paine, vice-president and traffic manager.

Elmo Edwards, secretary.

The directorate is composed of George H. Taylor, Albert W. Harris, Chester Corey, Chester A. Cook and Holmes Forsyth, all of Chicago, and E. D. Adler and John C. Partridge of Milwaukee and F. E. Connors and Waldo G. Paine of Spokane.

According to the tabulated report submitted to Mayor Fleming by Mr. Connors, the local lines carried 72,306 more passengers in January, 1920, than in January, 1919, and collected an increase in cash fares of $9,680 in the same period. In the last month the company's cars carried 823,425 passengers, as against 751,119 in January, 1919, and 940,031 in 1918.

New Haven Wants Its Trolleys Back

The New York, New Haven & Hartford Railroad would like to get back the lines of the Connecticut Company, which operates more than 90 per cent of the electric railway mileage in that State, and which is run by federal trustees under a federal court order that it be divorced from the steam road system.

Edward G. Buckland, president of the New Haven road during the period of federal control, told the correspondent of the ELECTRIC RAILWAY JOURNAL of the desire of his road on Feb. 28 as he finished his work as head of the road. Mr. Buckland said:

> I think that a unified system of transportation by steam road, trolley and steamboat is most desirable for southern New England. For this reason the New Haven would like to operate the electric railways in Connecticut, under the provisions of the railroad law which gives the Interstate Commerce Commission great regulatory powers. The Rhode Island electric railway properties are in receivership, and the Massachusetts and New York properties do not lend themselves to consolidation with the steam railroad.

It is likely that the New Haven will petition the Interstate Commerce Commission within the next year for a recommendation to the United States Courts asking that the steam road be allowed to take back the Connecticut Company's lines.

Financial News Notes

Average Fare Reported Incorrectly.—In the second paragraph from the last in the article on the Toronto (Ont.) Railway in the ELECTRIC RAILWAY JOURNAL for Feb. 14, page 352, the average fare during 1919 was quoted at 8.9 cents per revenue passenger. This should have read 3.9 cents.

Town Votes to Take Over Road.—The town of Turner, Me., has voted to take over the electric railway between Turner and Auburn, the operation of which was not resumed by the Androscoggin & Kennebec Railway, the successor under foreclosure to the Lewiston, Augusta & Waterville Street Railway.

Wants Service Decision Hurried.—A petition carrying the names of 600 citizens of Racine, Wis., has been presented to the Wisconsin Railroad Commission urging that body to speed its decision in the investigation of railway service in Racine as furnished by the Milwaukee Electric Railway & Light Company there.

Plan to Study Service-at-Cost.—The managing committee of directors now in active charge of the officers of the Louisville (Ky.) Railway pending the election of a successor to T. J. Minary as president, plans a tour to study at first hand the workings of service-at-cost grants where such ordinances have been in operation sufficiently long to establish authentic data.

Atlanta Bond Issues Authorized.—The Georgia Railroad Commission has authorized the Georgia Railway & Power Company, Atlanta, Ga., to issue additional bonds in the amount of $601,000, and the Georgia Railway & Electric Company to issue bonds in the amount of $189,000. Both issues are under the original mortgage to cover improvements for the six months ended Dec. 31, 1919.

Spokane Officers Re-elected.—At the annual meeting of the Washington Water Power Company, Spokane, Wash. recently, the officers and trustees were re-elected. J. D. Porter takes the place of Dr. N. Fred Essig, deceased. During the year 18,478,611 passengers were carried on the Water Power lines. This total was greater than in any year since 1913, but still 6,000,000 short of the maximum number in 1910.

Equipment Trust Securities Asked.—The New York & Stamford Railway has applied to the Public Service Commission for the Second District of New York for authority to issue at par $30,000 in 7 per cent equipment trust notes to be used for purchasing seven steel one-man safety cars. The road operates between New Rochelle, N. Y., and Stamford, Conn. The cars have a seating capacity of thirty-two.

Agree to Bond Extension.—F. H. Dewey, president of the Worcester (Mass.) Consolidated Street Railway, is quoted as authority for the statement that holders of the $700,000 of 4½ per cent debenture bonds due on Mar. 1, 1920, will be offered the right to extend the bonds to Mar. 1, 1925 at 7 per cent. Holders of $500,000 have agreed to extend.

Recommends Short-Term Financing.—State Treasurer Burrill of Massachusetts has recommended to the Governor a change in act providing for purchase of Cambridge subway, deciding to finance purchase with short term notes rather than with fifty-year bonds as provided in the act. He expresses the opinion that the money market will fall a full point during next year, and, if such proves to be the case, the Commonwealth, he says, will save at least $500,000 by deferring the issuance of bonds.

Boston Elevated to Issue Bonds.—The Public Utilities Department of Massachusetts has authorized the Boston Elevated Railway to issue notes or negotiable bonds to an amount not exceeding at par value $1,500,000, said notes or bonds to be payable in a period not exceeding thirty years from the date of issue and to bear interest at a rate not to exceed 7 per cent per annum. These notes or bonds are to be used for paying and refunding bonds to the amount of $1,500,000 due on March 1, 1920.

Court Will Pass on Service Discontinuance.—Three judges of the Supreme Court of Nevada sat *en banc* recently to hear the proceedings on the injunction which was brought by citizens of Reno, Nev., to prevent the Reno Traction Company from discontinuing local service. The case was concluded and the judges now have the matter under advisement. Decision may be rendered in from two days to two weeks. Meantime, the local system has been stopped entirely, but the interurban service between Reno and Sparks is continued.

Suggests Valuation at Akron.—The Northern Ohio Traction & Light Company, Akron, Ohio, has requested that the railway lines of the company in that city be valued by a board of arbitration as a step in the direction of affording relief to the company from the burdensome conditions under which it is now operating. A. C. Blinn, general manager of the company, has suggested a board of three, one member to be appointed to the company, one by the city and the third by the two so chosen. The Council has taken the matter under advisement.

Traffic and Transportation

Temporary Increase Urged

Public Service Commissioner Recommends Fare Agreement in Rochester as Solution of Service Problem

A temporary agreement between the New York State Railways and the city of Rochester, N. Y., under which the company would be permitted to increase its fares on its Rochester lines for a period of three months, was proposed by Public Service Commissioner John A. Barhite of the Second District at a hearing in Rochester on Feb. 28. Commissioner Barhite made his suggestion for a temporary suspension of the 5-cent fare provision of the company's franchise as offering the best hope of a solution of the city's transit difficulties, which the company contends cannot be reached without an increase in revenue.

Commissioner Barhite urged the company and the city to "get together" and agree on the points at issue to improve the service in Rochester, admitted by company officials to be inadequate. The Public Service Commission had ordered the company to show cause why it should not improve the service. In all, three hearings were held, at which Commissioner Barhite examined witnesses for the company and the city. The hearings are now concluded. It is believed that under existing conditions the commission will refuse to order the company to improve the service.

Company Welcomes Agreement

Under the temporary agreement the company would be granted a fare of 6 or 7 cents for a limited period, during which its books would be open to public inspection. The company has already expressed its willingness to accept such an agreement. Daniel M. Beach, its counsel, said in this connection:

> We are not asking that the contract with the city by which we are required to furnish a 5-cent fare be abrogated. We are simply asking for its suspension and the right to charge a just fare while operating costs are too much to permit of good service at that rate. When the time comes that a 5-cent fare is sufficient the suspension could and should be lifted.

The company's books showed a balance of $300,000 for the year 1919, according to testimony at the hearing by representatives of the city. The attorneys for the company, declared, however, that this sum did not allow for deferred maintenance, the cost of trackage, equipment need renewals and replacements which they said aggregated several hundred thousand dollars. The attorneys stated that the increase in service demanded by the city authorities would cost the company $500,000 additional, and together with the future raises in employees' salaries would total $553,000. It was contended that in order to give better service the company would have to abolish the present 5-cent fare and charge 7, 8 or even 9 cents.

General Auditor Joseph M. Joel of the company, while under cross-examination, testified as to the value of the company's property within the city of Rochester. Asked as to the allocation of the salary of President James F. Hamilton and the expenses of administering the offices of the New York State Railways, Mr. Joel said that slightly more than a third is paid by the Rochester lines.

Corporation Counsel Charles L. Pierce asked representatives of the company for a statement of its expenditures for renewals and replacements for the years from 1909 to 1917 inclusive. It was said that it would take six weeks of searching through vouchers to give the information. On the Charlotte line, which is an appendage to the Rochester lines, a 6-cent fare has been charged and for the past three years subject to a decision by the Public Service Commission as to whether or not that rate is more than should be asked, rebate slips have been issued to patrons on this line. It was said on March 1 that the slips issued to date amount to approximately $223,443.

New Jersey Fixes Fare Rights

The New Jersey Supreme Court at Trenton has affirmed with costs the findings of the Second District Court in the matter involving Mayor Charles P. Gillen, of Newark, and the Public Service Railway. The decision holds that the railroad companies possess the legal right to raise rates of fares at will, subject, of course, to suspension later by the Board of Public Utility Commissioners. Mayor Gillen, a passenger on a Public Service Railway car, refused to pay a 7-cent fare after the Utility Board had set a rate of 6 cents for the company. The matter was threshed out in the Newark District court, and the verdict rendered was favorable to the railway. Mayor Gillen took an appeal.

The court says that the legal question is whether the railway could lawfully raise its fares without an order of the commission and a delay of twenty days before proceeding under the order. The court said:

> This question was definitely settled in the case of O'Brien against the Public Utility board, and where it was held that the railway possessed such a right, and that case is controlling here. It was made clear in the case referred to that the raising of the rates was as a matter of course, subject to intervention by the Public Utility Board, who may suspend the fares. The proposition is self-demonstrating that if the defendant company had the right to raise the fare, it needed no order and no twenty days' delay before putting the order into effect. The judgment of the District Court is affirmed with costs.

Sees Hope for I. R. T.

Can Continue to Operate Temporarily at Present Fare, Says President Hedley at Traction Inquiry

Frank Hedley, president of the Interborough Rapid Transit Company, admitted under questioning at the resumption of the hearings before the New York City Board of Estimate on March 3 that the company could continue to operate, for the present, at least, on a 5-cent fare. While urging the necessity of an increase in the company's revenue, Mr. Hedley stated that the lines would not go out of business on July 5 next unless an 8-cent fare were obtained before that date, when, it had previously been predicted, the system would be driven into bankruptcy.

Mr. Hedley stated it as his personal conviction that the company would be able to continue beyond July 5 next and still pay its debts. Comptroller Craig thereupon asked why the company could not put up with a 5-cent fare until July 5, 1921. The witness replied that "the company has certain obligations to meet." He further declared that it was not he who had named July 5 next as the day of fate for the Interborough. Asked concerning the quality of the service furnished by the company, Mr. Hedley said:

> With the revenue as it is at present, I consider the state of the subway highly efficient. We are carrying more passengers than any other road in the world, and we are doing it with a higher degree of safety.

The Comptroller then asked if Mr. Hedley considered it fair for the Interborough to fall down on its part of the contract, and for the people to continue to pay the fare. "Supposing the people regarded the fare as too high and refused to pay?" he asked.

Mr. Hedley said that he was willing at any time to sit down with the board and devise any practical means of solving the problem. He added that it was absolutely essential that the people eventually should pay an adequate fare, something between 8 and 10 cents. At present, he said, the Interborough has not funds enough to meet the returns on its investments, and capital under these circumstances cannot be attracted.

The Comptroller then inquired whether the Interborough was willing to permit the city to buy the security holders out, and cancel all contracts. After this, he said, the city could arrange the rate of fare to its own satisfaction. Mr. Hedley said that he would consider any proposition offered, and that in the case the city was able the raise sufficient funds, which he much doubted, he would recommend to the board of directors that they sell out. The price, he said, would be in the neighborhood of $400,000,000.

Mr. Hedley maintained, in answer to questions by Corporation Counsel Burr, that the railroad was giving comfortable and adequate rapid transit to the best of its ability. Asked what prevented the railroad from giving complete accommodation to the traveling public, the witness replied the construction work under the contracts had not been finished.

Safety Cars Did It

Terre Haute's Rejuvenated Traction System Bears Witness To Their Accomplishments

"Safety Cars." These two words sum up very largely the history of the Terre Haute Traction & Light Company, Terre Haute, Ind., for the past year as far as public relations are concerned. They even do more than that. They stand for a revolution in the habits of a community of more than 60,000 persons. Two years ago Terre Haute's railway equipment was worn out. The company had no funds for replacements. Everybody was disgruntled.

Then something happened. Through strenuous efforts the company secured a loan for the purchase of thirty one-man safety cars. Even the local investors subscribed. The first batch of new cars arrived at Terre Haute in November, 1918. Everyone wondered how they would work. They had not long to wait. From the time the cars arrived a change for the better was apparent. With their advent the whole traction system began to speed up. The improvement continued. Today there are fifty-six one-man cars operating in Terre Haute. The people who ride in the cars now say that their city has the best railway service in the country. They are the ones who know. The safety cars are admitted to have been the chief factor in bringing about the change.

Not only are the people of Terre Haute proud of their revamped trolley system. They like to talk about it. In fact, they take delight in putting it through its paces. When ex-Secretaries of State, movie queens or other visiting dignitaries arrive in town the residents do not take the illustrious strangers on a tour of the public library or the scene of the latest divorce scandal. Oh, no! They are too good salesmen for that. They want their guests to see Terre Haute at her best. So they take them for a ride on the "safeties."

Even the local newspapers "boost" the trolley. Most editors are more afraid of praising railway managers than a husband of two weeks is of being five minutes late for dinner. Not so the Terre Haute scribes. They believe in being different. Or perhaps it is merely that they appreciate getting to the office on time. Anyway, they laud the trolley management. The accompanying article, which recently appeared in the Terre Haute *Star*, is concrete evidence of their attitude. Through it runs an unmistakable note of pride in the local system. A portrait of E. M. Walker, general manager of the company, accompanied it. Here is the article:

With an announcement by General Manager E. M. Walker yesterday that more people were carried on Terre Haute street cars this month than any other January in the history of the city, attention was directed to the metamorphosis that the local street-car system has experienced in a little over a year.

From a small number of old style cars, many of them out of repair, because no one of them could be spared from service long enough for an overhauling, to a fleet of more than sixty, fifty-six of which are brand new and of the latest design—from one of the poorest street-car services in the country to one of the very best, has been the experience of this system, much to the satisfaction of the citizens of Terre Haute.

There were short periods in the year 1918 when less than twenty cars were in operation at one time on the streets of the city. Rejuvenation of the system began in November, 1918, with the delivery of the first five or six of the thirty safety cars that had been ordered some months previously. These cars were put into service as fast as they arrived here, the South Seventh Street line being equipped first.

More Cars Ordered

No sooner had the thirty cars embraced in the first order been delivered than plans were set in motion to obtain almost as many more, and with the aid of some local bankers, money was obtained to buy twenty-six more cars. The last of these were installed more than two months ago, with the result that every line in the city is operated with safety cars, with the exception of Wabash Avenue.

The new cars enabled the company to give much more frequent service, three and four minute schedules being maintained on nearly all lines during the rush hours of mornings and evenings, while six, seven and eight minute service is maintained at other hours.

"Of course we have to do more business to make this better service pay," said General Manager Walker, "but with improvement in the service, there has been a corresponding increase in the number of passengers carried. This increase has been going on right along as our service improved, and in point of gross receipts, that is, of passengers carried, this January is the best January we ever had. I think I am safe in saying that as a result of the public's response to our efforts to give the best street-car service in the United States, there is no indication that we will anyways soon have to ask for an increased fare. In other words, while other cities are asking and receiving a fare of from 6 to 10 cents, we are getting along very comfortably on a 5-cent fare and our business is showing a healthy increase over the same period a year ago."

Safety Car Proves a Success

This situation is said to be due to the flexibility and economy of the safety car, which other cities are rapidly adopting. The success of these cars here has been so great that there has hardly been a week during the last six or eight months that delegations have not come from other cities to inspect our street-car system with a view of modeling theirs after it. Just a few months ago a delegation was here from Brooklyn, N. Y., and as a result of what they saw more than 200 safety cars were ordered for that city.

One of the noteworthy things about this improvement in service and the thing that indicates the greatest confidence in the city of Terre Haute, is the fact that money to make these improvements could be obtained at a time when street-car systems in other places were barely able to pay their running expenses. All of the money for the Terre Haute improvements was borrowed in Indiana, and not in considerable part of it came from Terre Haute.

More Improvements Planned

Mr. Walker states that the program of improvements is not completed by any means and that these will be carried on as fast as money can be obtained for them. It is not improbable that more safety cars will be ordered before the year is much older, and it is probable also that the Water Street power station, which is already one of the finest in Indiana, will be enlarged by the addition of boilers and machinery of the latest and most improved type.

Fare Increase Anti-Parking Alternative

The Los Angeles (Cal.) Railway will be compelled to raise its fare if the plan worked out by the State Railroad Commission for the relief of congestion in Los Angeles is defeated through rejection of the "no parking" ordinance recently passed by the City Council. Warnings to this effect have been issued by Assistant City Attorney Stephens, who points out that the "no parking" ordinance is part of a comprehensive plan worked out by the city and by engineers of the State commission for general relief of congestion. Petitions for a referendum election to pass on the ordinance are being circulated. Mr. Stephens urged all persons not to sign these.

Representatives of the Railroad Commission repeatedly warned the councilmen during a hearing on the new ordinance that failure on the part of the city to enact such legislation would block the plan outlined for rerouting cars. The car rerouting plan was worked out by the State officials as the only means for preventing increases in car fares in Los Angeles. Commissioners Edgerton and Brundidge of the commission pointedly informed city officials that the present traffic congestion in the downtown streets was such that the street cars could not be operated on schedule. The ordinance has been published and will become effective April 10, at which time the rerouting plan will be put into effect, unless halted by the referendum.

Appeals for Public's Co-operation

The "home rule" committee recently appointed to manage the Quincy (Mass.) division of the Eastern Massachusetts Street Railway, has appealed to the people of Quincy for their support. The committee asks the public's co-operation in giving the city the best street railway in the State. The appeal, which was placed in all Quincy cars in the form of display posters, follows:

For Quincy's Sake

The Quincy Street Railway is now operated by a Home Rule Citizens' Committee composed of Quincy business men.

Fares, service and other problems are to be settled by this purely local committee.

Everyone's help is needed.

More cars, better cars, quicker service and the lowest possible fares are our aims.

Praise or criticism of the road and its employees is desired.

Let's get together for Quincy's sake and give the city the best street railway in the State. It can be done if you'll help.

Therefore send in your suggestions or criticisms, either by letter or personally to any member of the committee:

Forest I. Neal, chairman; Henry L. Kincaide, S. W. Wakeman, Charles L. Gilliatt, Walter E. Barry, Herbert S. Barker and C. L. Young.

Staggered Hours Tried in Richmond

The Lorillard Tobacco Company, Richmond, Va., has voluntarily adopted as a permanent plan the staggered-hour system of assembling and dismissing employees. The employees are divided into groups who come to work at 7, 7:15, 7:30, 7:45 and 8:00 a.m., and leave at intervals from 4:30 to 5:30 p.m. The plan was first put in on trial and it worked out so well that it has been adopted permanently. This scattering of the load throughout an hour, both morning and evening, practically removes the peak for the railway company in connection with this particular plant. The idea is gaining in favor with other Richmond employers. In a letter to the Virginia Railway & Power Company, in regard to this matter, J.

N. Dart, general manager of the tobacco company, wrote as follows:

As you know, we have at all times tried to co-operate with the Virginia Railway & Power Company, as we realized that it is to our interest as much as to theirs to get our people to work at such times as will enable them to avoid the rush, both coming to work and going home.

It might further interest you to know about the plan which we have recently put into effect, whereby we sell our employees street-car tickets in the building. This enables them always to have a ticket when they get on the car and so they do not have to wait for change. This scheme works very nicely, and our employees are taking advantage of it, having bought $250 worth of tickets within the past ten days.

Transportation News Notes

Increase on New York Interurban.—Increased rates have been authorized for the Utica and Oneida lines of the New York State Railways, Syracuse, N. Y., the schedule of increase affecting all lines between Utica, Little Falls, Frankfort, Ilion, Mohawk and Herkimer.

Asks Seven Cents in Oneonta.—The Southern New York Power & Railway Corporation, Cooperstown, N. Y., has applied to the Public Service Commission for the Second District for authority to charge a 7-cent fare on its lines in Oneonta. The present fare is 5 cents.

Lower Fare for Revere.—The public trustees of the Eastern Massachusetts Street Railway have reduced the fare in Revere, Mass., from 10 cents straight to sixteen tickets for $1. The reduction was made in accordance with the company's policy of reducing fares wherever conditions warrant such a course.

Fare Reduced in Montpelier. — The City Council of Montpelier, Vt., has authorized Mayor Shurtleff to sign an agreement with the Montpelier & Barre Traction Company by which the fare in Montpelier will be 5 cents instead of 6 cents, as heretofore. The Council has permitted the company to increase its rate beween Barre and Montpelier from 15 cents to 18 cents.

"Complaint Cards" in Detroit.—The cars of the Detroit (Mich.) United Railway have been equipped with "complaint card boxes," placed at the exit end of the car together with a supply of complaint cards so that violation of traffic ordinances observed by passengers may be reported easily and quickly. The cards are collected each night at the carhouses and sent to the complaint bureau.

Fare Briefs Filed.—The city's brief in the hearing of the Portland Railway, Light & Power Company, Portland, Ore., before the Public Service Commission asking for an increase in revenue, has been filed with the commission by City Attorney Stanley Myers. The company's brief has also been filed, and the Public Service Commission hopes to arrive at some decision in the matter within thirty days.

Seven-Cent Fare Urged.—In applying for a 7-cent fare in the District of Columbia, William F. Ham, president of the Washington Railway & Electric Company, declared that at the present rate of income his company is earning only 3½ per cent on its investment. Mr. Ham expressed the opinion that the Public Utilities Commission should allow a 7-cent fare with 2 cents for transfers for the period beginning May 1.

Staggered Hours Helpful. — Very satisfactory results are reported by the railways in Washington as a result of staggered hours in the Government departments. The congestion on cars has been measurably relieved, both in the rush hours of the morning and in the afternoon by spreading the hour for reporting for duty between 8:45 and 9:15 o'clock, instead of all reporting at 9 o'clock as formerly was the custom.

Safety Campaign in Toledo.—"Safety" posters are a feature of a campaign which the Toledo Railways & Light Company, Toledo, Ohio, is conducting for the reduction of the number of accidents on its lines. The company has placed the posters in its cars and in other public places. Accidents involving the company's cars numbered 169 in January, 1920, as compared with seventy-four for the same month of 1919.

Suspends Seven-Cent Rate.—Owing to protests from the city authorities of Phillipsburg, N. J., the Phillipsburg Transit Company did not raise its fare to 7 cents on March 1 as it had proposed doing. The municipality has applied to the Interstate Commerce Commission for a hearing on the company's petition for a rate increase. The company operates in Phillipsburg and neighoring New Jersey and Pennsylvania towns.

Will Grant Six-Cent Fare.—The City Council of Little Rock, Ark., has directed the city attorney to prepare an ordinance granting the Little Rock Railway & Electric Company a 6-cent fare for a period of three years. This action was taken after the approval by the Council of the report of the public utilities committee, which urged financial relief for the company through a higher fare. The company's petition for an increase has been under advisement for several months. The present fare is 5 cents.

Jitneys Under Ban in Lowell.—Operation of jitneys in Lowell, Mass., ceased on March 1 by order of the City Council. The Council had previously passed an ordinance barring the jitneys from all streets served by the Eastern Massachusetts Street Railway. This action was taken at the instance of the "home rule" committee recently appointed to manage the Lowell division of the company. Company officials estimated that the annual loss in revenue due to jitney competition in the Lowell district amounted to $50,000.

Would Carry Fare Plea to Courts.—The New York, Westchester & Boston Railway, New York, N. Y., has applied to Supreme Court Justice Platzek for a writ of certiorari to compel Lewis Nixon, Public Service Commissioner for the First District, to produce in court all documents relating to the hearings on the company's application for a higher fare. The company seeks to raise the rate for passengers riding within the corporate limits of New York City from 5 cents to 7 cents. Commissioner Nixon has refused to grant the increase.

Fare Case Still Pending.—The matter of fares on the Memphis (Tenn.) Street Railway is still up for discussion at Nashville before the State Utility Commission. The railway is seeking to raise its fare from 6 cents to 7 cents with a charge for transfers. This is bitterly opposed by the Memphis city government, Mayor Rowlett Paine having appeared in person before the commission. It is intimated that a fight in the courts will ensue if the rate is raised above 6 cents. There is also considerable talk in Memphis of rerouting many of the lines.

Theatres Advertise Subway Advantages.—The Shuberts, New York theatrical producers, have distributed among their patrons a leaflet containing directions for reaching their theatres via the Broadway subway, operated by the New York Consolidated Railroad. The location of the twenty Shubert theatres along the "Rialto," or Broadway theatre district, is shown on a map, on which the route of the Broadway line is also marked. The leaflet also contains information concerning important buildings and other points of interest along the line.

Freight Rates Up Twenty Per Cent.—The Aurora, Elgin & Chicago Railroad, Aurora, Ill., has filed tariffs with the Illinois Public Utilities Commission providing increases of approximately 20 per cent in its freight rates. The company seeks to abandon its collection and delivery service to the Interurban Motor Despatch Company, a freight and express company operating over its lines. The new tariffs raise the rate from 30 to 40 cents on shipments between Elgin and St. Charles and Geneva. Corresponding increases are made between other points. The new rates are now in effect pending approval by the commission.

Eight Cents on Hudson Tubes.—The Hudson & Manhattan Railroad, operating the tubes under the Hudson River connecting New York City with New Jersey points, has posted a new local passenger tariff schedule effective April 4, under which it proposes to raise the fare bewteen the Hudson Terminal, Manhattan, and Jersey City and Hoboken from 5 cents to 8 cents. The fare between stations in New Jersey and stations in New York City other than the Hudson Terminal, now 7 cents, is also to be raised to 8 cents. The only 5-cent fare left is for a ride between the Jersey City and Hoboken

stations and between stations in Manhattan.

Lower Ticket Rate Ordered — The Indiana Public Service Commission has ordered the Chicago, South Bend & Northern Indiana Railway, South Bend, Ind., to cancel all commutation fares calculated on the basis of 2 cents a mile and to establish in lieu thereof fares on the basis of $.01875 a mile, the rate charged by the Chicago, Lake Shore & South Bend Railway, which operates in the same territory. Commutation books are to be made up of forty tickets with a minimum charge of $4 a book and 10 cents a ride. The Chicago, Lake Shore & South Bend Railway has been authorized to establish a minimum commutation fare of $4 for forty rides, or ten cents a ride.

City Backs Five-Cent Fare Suit.— Justice Clark, of the Appelate Term of the Supreme Court in Brooklyn, has given permission to Corporation Counsel Burr of New York City to intervene in the suit instituted by Julius Merksamer, to recover 5 cents charged him by the Brooklyn Rapid Transit Company. It is claimed that the extra 5 cents was charged for a ride to Coney Island, on the Sea Beach line, and that not more than 5 cents should haye been charged. The suit was tried in the Municipal Court in Brooklyn, and resulted in a victory for the company. If the appeal is successful, the fare to Coney Island on the Rapid Transit lines will be only 5 cents thereafter.

Revocation of Jitney Licenses Upheld.—The repeal of jitney licenses in the city of Brockton, Mass., by the City Council after the Eastern Massachusetts Street Railway had threatened to discontinue service unless jitneys were eliminated as competitors was upheld by the Supreme Court of Massachusetts in a recent decision handed down by Chief Justice Rugg. The opinion of the court says that the Aldermen acted in good faith and in the exercise of a reasonable discretion in the interest of public safety and convenience as they believed, to the end that the mode of transportation which they thought best calculated to serve the best interest of the entire population of the city might be preserved and maintained.

Less Traffic in Kansas City. — The Kansas City (Mo.) Railways reports that it now has in service during the evening rush hours 641 cars and twelve trailers, and in the morning rush hours 555 cars and twelve trailers. This is almost exactly the same service that was supplied in July, 1917, but the average daily number of passengers now is 310,000 as against 370,000 in 1917. This decrease is attributed largely to the jitneys and the growing habit of auto owners in picking up passengers on the street and carrying them downtown. The increase in population of Kansas City is estimated at 50,000 within the last three years. The increase in the number of automobile owners is about 13,000 in the same period.

Asks Riders' Support to Prevent Breakdown.—James F. Hamilton, president of the New York State Railways, has addressed to the people of Rochester an open letter asking their support in the company's effort to obtain financial relief for the Rochester lines through an increase in fare. Mr. Hamilton points out that the Rochester lines carry 275,000 passengers daily, although the population of the city is less than 300,000. He calls attention to the fact that the company needs $1,000,000 to put its tracks and equipment in good condition. Mr. Hamilton suggests that car riders use their influence with the city authorities to prevent a total breakdown in the city's transportation system which threatens because of lack of funds.

Appeals for "Safety First."—H. O. Allen, safety engineer of the Beaver Valley Traction Company, New Brighton, Pa., believes in carrying the message of "safety first" into the homes of the company's men. He recently drew up and sent to each employee a series of talks in letter form, dealing with the problem of eliminating accidents on the company's lines. Mr. Allen discussed among other topics, proper braking of cars, the operation of door devices, and the regulation of car speed. He called the men's attention to the fact that, if they had any questions to ask regarding proper car operation, they should come to him for their answers, and that, while it was his business to show them the correct methods, they should not feel that he would report them for mistakes.

Six Cents in Charleston.—The Charleston (W. Va.) Interurban Railway has received permission from the State Public Service Commission to raise its fare within the Charleston city limits and its interurban rates. The commission has authorized a 6-cent city fare. The company had applied for a 7-cent fare. The increase in interurban rates asked by the company was granted without objection. The books of the company showed gross earnings of $261,000 with operating expenses of $244,500 and net earnings of $17,000. George R. C. Wiles, chairman of the commission, stated that the company was entitled to earn 11 per cent upon its investment to include depreciation and risk. It is estimated that the increase in fares will raise the net earnings to $22,000.

Referendum on Columbus Fares.— The 6-cent fare ordinance recently passed by the City Council of Columbus, Ohio, will be submitted to the voters of that city at a referendum election on April 27. The ordinance as passed by the Council grants the Columbus Railway, Power & Light Company a 6-cent cash fare for a six-year period. During the first two years the company is to sell five tickets for 25 cents and during the remaning four years six tickets for 25 cents. The company is permitted to charge 10-cent "owl car" fare. Free transfers are retained. Under the terms of the ordinance the company binds itself to improve service, pay its share of necessary street paving, and make not more than six miles of extensions within the six-year period at a cost of not more than $3,000,000.

Further Transfer Curtailment. — The Public Service Commission for the First District of New York has issued an order permitting the Belt Line Railway Corporation to file a new schedule on short notice, showing the elimination of transfers between the Fifty-ninth Street Crosstown line and the Madison Avenue line. The Fifty-ninth Street Line is owned by the Belt Line Railway Corporation, a part of the Third Avenue system, while the Madison Avenue line is being operated by the New York & Harlem Railroad, the owner of the property, to which company it was returned by an order of the court a few weeks ago. The New York & Harlem Railroad recently notified the Belt Line Corporation that, beginning March 1, it would discontinue giving transfers to, or accepting them from, the Fifty-ninth Street line.

Unprecedented Traffic Increase in Brooklyn.—Directions have been given by the Public Service Commission for the First District of New York to the operating officials of the Brooklyn Rapid Transit elevated and subway lines, the effect of which is to call for improvement in the serivec on those lines. Owing to the recent storm, which greatly delayed surface railroad operation, an enormous amount of traffic was diverted to the subway and elevated lines, so that for the month of February the total increase of traffic upon these lines aggregated 40 per cent. This great growth has had the effect of overloading the company's facilities. Investigations made by the commission have recently shown that at times there was as high as 20 per cent of the rolling stock of the elevated and subway lines in the shops awaiting repairs. This fact has also helped to make the present congestion a serious one.

Plans Fight on One-Man Cars. — The city of Richmond, Va., will shortly begin legal proceedings to bar the use of one-man cars by the Virginia Railway & Power Company, according to an announcement on Feb. 24 by Commonwealth's Attorney George E. Wise. Mr. Wise stated that he was preparing a petition for a writ of quo warranto against the company. Action against the one-man cars was first taken by John Hirschberg, candidate for mayor, who filed injunction proceedings in the Law and Equity Court, declaring that the operation of the cars was contrary to the charter of the city and a direct violation of the franchise of the company. He further claimed in the proceedings that the cars were unsafe. Judge Beverly T. Crump decided that he was without jurisdiction unless action was filed by legal representatives of the city, and Mr. Hirschberg then asked the Commonwealth's attorney to act. It is charged that the cars violate flagging regulations at grade crossings.

Personal Mention

Mr. Fish Again in Chicago

Leaves West Penn Railways to Become General Manager of Chicago Surface Lines—Other Changes

The Board of Operation of the Chicago (Ill.) Surface Lines at its meeting on Feb. 24 appointed Williston Fish, vice-president of the West Penn Railways, Pittsburgh, Pa., to the position of general manager of the system. Mr. Fish's appointment was briefly noted in the ELECTRIC RAILWAY JOURNAL for Feb. 28. Mr. Fish was general manager of the Chicago Railways until the time of the operating consolidation with the Chicago City Railway in 1914, when he became connected with the West Penn System. He therefore returns to Chicago thoroughly familiar with operating conditions in that city and well equipped to cope with the problems confronting the surface lines.

OTHER CHANGES ANNOUNCED

At the meeting on Feb. 24 the Board of Operation also made the following appointments:

Frank L. Hupp, formerly assistant secretary, was advanced to secretary. Mr. Hupp is also secretary of the Chicago Railways.

F. D. Hoffmann, formerly secretary and assistant treasurer, was appointed assistant secretary and assistant treasurer. Mr. Hoffmann is also secretary and treasurer of the Chicago City Railway.

M. B. Orde was made treasurer of the Chicago Surface Lines. He is also treasurer of the Chicago Railways.

John J. Duck was reappointed general auditor. Mr. Duck is auditor of the Chicago City Railway.

W. W. Gurley was reappointed general counsel.

No changes in the department heads, further than those already published in the JOURNAL, have been announced by President Blair, and the former heads are being continued until further notice.

CAREER OF MR. FISH

Mr. Fish was born at Berlin Heights, Ohio, in 1858. He entered Oberlin College in 1876 and in the following year was appointed to West Point. Graduating from the military academy in 1881 with high standing in mathematics, engineering, law and languages, he was appointed a second lieutenant of the Fourth U. S. Artillery. He served with that regiment for several years at San Francisco, New London, Conn., and Fort Snelling, Minn., meanwhile continuing the study of law.

Resigning from the army in 1887, he entered the employ of the Crane Elevator Company, of Chicago, as a salesman. He remained with the company for a little more than a year. He meanwhile resumed the study of law in the school of Judge Thomas Moran, and was admitted to the bar in 1897.

Mr. Fish's connection with the street railway industry began in 1890, when he joined the South Chicago City Railway. For the next nine years he served as right-of-way and claim agent and assistant counsel of the company. During this period he acquired most of the right-of-way for the company and drew up all the contracts.

In 1899 Mr. Fish was appointed assistant to Jesse Spaulding, president of the Chicago Union Traction Company, continuing in the same capacity under John M. Roach, Mr. Spaulding's successor. As aide to Mr. Roach he had an important part in the valuation of the property of the Chicago Union Traction Company and in the negotiations for the settlement ordinance of 1907. When Mr. Roach became president of the newly-organized Chicago Railways, Mr. Fish remained with him as his assistant. In February, 1912, he was elected vice-president and general manager of the company.



WILLISTON FISH

Upon the operating consolidation of the Chicago Railways and the Chicago City Railway to form the Chicago Surface Lines in 1914, Mr. Fish was made vice-president of the system, resigning, however, in the same year. About the same time he was chosen vice-president of the West Penn Traction & Water Power Company and the West Penn Railways.

In addition to his duties with the West Penn Railways, Mr. Fish has served as president of the Wheeling (W. Va.) Traction Company and as an official of several other companies controlled by the West Penn Railways. He has taken an active interest in the work of the American Electric Railway Association, presenting a paper on the subject of depreciation before the recent mid-year meeting of the Association at Cleveland.

Col. R. A. Mitchell of Gadsden has been elected a vice-president of the Alabama Power Company, Anniston, Ala.

George R. Hart has been appointed assistant general manager of the Sacramento Northern Railroad, Sacramento, Cal.

R. E. Luellen has been appointed safety engineer of the Union Traction Company of Indiana, Anderson, Ind. Mr. Luellen is the editor of *Safety*, the company's magazine.

J. W. McNeely, superintendent of transportation of the Paducah (Ky.) Traction & Light Company, has been appointed superintendent of the Paducah Railway, which recently took over the property of the former company.

Archibald Page, general manager of the Glasgow Corporation Tramways Department, Glasgow, Scotland, has resigned. Mr. Page has been appointed a member of the Commission under the Ministry of Transport for the control of the electrical supply of Scotland.

H. M. Aldrich, formerly superintendent of the Northampton Street Railway, has been appointed by the Massachusetts Department of Public Utilities to be inspector of street railways and street railway equipment for the western district of the State.

John M. Johnson, traffic superintendent of the Trenton & Mercer County Traction Corporation, Trenton, N. J. has resigned. Mr. Johnson joined the company in the fall of 1919. He was formerly superintendent of the Ithaca (N. Y.) Traction Company.

Leslie W. Spraggon has resigned his position with the Connecticut Company where he has been inspector of rolling stock for the past two years, to take effect March 1. He goes to the Boston office of the Westinghouse Electric & Manufacturing Company as travelling salesman.

James T. Hutchings has resigned as president of the Rochester Gas & Electric Corporation, Rochester, N. Y., to become assistant general manager of the United Gas Improvement Company, Philadelphia, Pa. Mr. Hutchings was president of the Rochester Railway & Light Company from 1904 to 1909.

T. K. Glenn has been elected president of the Georgia Railway & Electric Company, Atlanta, Ga., to succeed the late Frank E. Block. Mr. Glenn is vice-president of the Georgia Railway & Power Company, which operates the lines of the Georgia Railway & Electric Company.

G. M. Rozelle has been appointed division superintendent of the Union Traction Company of Indiana, Anderson, Ind., with headquarters at Muncie. Mr. Rozelle succeeds A. G. Snell, resigned. Prior to his appointment as superintendent he was an inspector for the company.

Maurice Dooley, superintendent of the Barre & Montpelier Traction & Power Company, Montpelier, Vt., has tendered his resignation to take effect on March 22. Mr. Dooley has been superintendent of the company for several years. He was formerly assistant superintendent.

J. C. Hallman has been elected vice-president of the Georgia Railway & Electric Company, Atlanta, Ga., the lines of which are operated under lease by the Georgia Railway & Power Company. Mr. Hallman succeeds T. K. Glenn, who has been chosen president of the company.

John J. Dempsey, who resigned some months ago as vice-president and general manager of the Brooklyn (N. Y.) Rapid Transit Company to become vice-president of the Seamans Oil Company, has been transferred by the company from New York to Oklahoma City, Okla., where he will hereafter live and make his headquarters.

W. E. Herring, for the last seven years industrial agent of the Puget Sound Traction, Light & Power Company, Seattle, Wash., has been transferred to the Boston offices of Stone & Webster. He is to be connected with the engineering department of the division of engineering and construction. Mr. Herring went to the company at Seattle from the position of chief engineer of the U. S. Forestry Service.

A. C. Colby, who has been master mechanic in the Bridgeport shops of the Connecticut Company, New Haven, Conn., for the past two years, has been transferred to the New Haven general offices with the title of mechanical engineer. He will take over the duties of Leslie W. Spraggon in connection with the company's reclamation shop. Before joining the Connecticut Company Mr. Colby was master mechanic with companies at Pittsfield, Mass., and Birmingham, Ala. He was appointed master mechanic of the Connecticut Company's Bridgeport shops in October, 1918, succeeding William F. McCoy.

G. J. Smith, superintendent of rolling stock and shops of the Kansas City (Mo.) Railways, resigned from that position on Jan. 31 and will engage in the automobile business. Mr. Smith has been actively engaged in electric railway work for the past thirty years, having organized the South Covington & Cincinnati Street Railway in 1890. In 1899 he resigned as master mechanic of that company to become master mechanic of the St. Louis & Suburban Railway, where he remained for two years. At the end of that time he joined the St. Louis Car Company as superintendent, in which position he accomplished important work in connection with truck design and methods of truck manufacture. He was one of the first to advocate an association of electric railway master mechanics. In 1904 Mr. Smith joined the Metropolitan Street Railways, now the Kansas City Railways, as superintendent of rolling stock and shops, which position he has held for the past sixteen years.

O. B. Coldwell Promoted

Now Vice-President Portland Railway, Light & Power Company in Charge of Light and Power Department

Under a reorganization of the operating personnel of the Portland Railway, Light & Power Company, Portland, Ore., Orin B. Coldwell, who for some time has acted as general superintendent, has been chosen second vice-president and has been placed in charge of the light and power departments. F. I. Fuller, first vice-president, has assumed charge of all railroad matters, which have heretofore been attended to by Mr. Coldwell. For operating purposes the railway department and the light and power department are again segregated.

Mr. Coldwell, the new vice-president, is one of the best-known operating men in the Northwest. He was born at Salem, Ore., in 1875. In 1892, while yet a student at the Portland High School, he entered the employ of the Willamette Falls Electric Company, a pioneer in the field of electric power transmission. During the next five years he was engaged in one capacity or another in practically every department of the Willamette Falls company.



O. B. COLDWELL

WIDE EXPERIENCE AS ENGINEER

Not content with a merely practical knowledge of electricity, Mr. Coldwell entered Leland Stanford University in 1897 as a special student in electrical engineering. Here he put in three years, spending his summer vacations in the employ of the Portland General Electric Company. In the fall of 1900 he entered Cornell University as a student in the electrical engineering course of Sibley College, and was graduated with the class of 1902. Returning to the West, he again joined the Portland General Electric Company, this time as assistant superintendent. He has since filled successively a number of positions with the company and its successor, the Portland Railway, Light & Power Company.

Mr. Coldwell has taken an active part in building up electrical engineering societies on the Pacific Coast. He was one of the organizers of the Northwest Electric Light & Power Association, of which he served as president in 1914. He was also instrumental in bringing about its affiliation with the National Electric Light Association. He is a member of both organizations and, in addition, a fellow of the American Institute of Electrical Engineers.

A. G. Snell, superintendent of the Muncie division of the Union Traction Company of Indiana, Anderson, Ind., has resigned. Mr. Snell has accepted the position of cashier of the Farmers' State Bank of Muncie. He has been connected with the Union Traction Company for more than fifteen years. He was appointed superintendent of the Muncie division in 1917.

Obituary

Frank E. Block, president of the Georgia Railway & Electric Company, Atlanta, Ga., whose lines are leased by the Georgia Railway & Power Company, is dead.

D. S. Robertson, purchasing agent of the Montreal (Que.) Tramways, died in Montreal from pneumonia on Feb. 27. Mr. Robertson was born in Glasgow, Scotland, sixty-nine years ago.

Andrew B. Bullock, superintendent of carhouses of the Kansas City (Mo.) Railways, died on Feb. 15. Mr. Bullock had been connected with the company for thirty-one years, beginning as a conductor.

R. L. Morley, electrical engineer of the Muskegon Traction & Lighting Company, Muskegon, Mich., died recently in Muskegon at the age of thirty-six years. Mr. Morley had been connected with the company for several years. He was graduated from the engineering department of Purdue University in 1909, and for three years thereafter served as electrical engineer of the Maine Short Line.

Henry B. Endicott, head of the Endicott-Johnson Company, and chairman of the Massachusetts Committee on Public Safety during the war, died in Boston on Feb. 12. During the war Mr. Endicott was called on to assist in the settlement of labor problems and in one year helped settle labor disputes involving 100,000 workers. He was not directly engaged in electric railway work, but filled offices in the Holyoke, Springfield and Boston Elevated railway settlements that drew the attention of the industry to him. He was a man of unusually broad sympathy and of fine understanding. He put public service above his own interests. The removal of the influence for good that he wielded in connection with labor matters makes his passing a distinct loss to Massachusetts and the nation at large.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER.

SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Heavy Coupler Orders Placed

Deferred Maintenance and Buying of New Equipment Responsible for Large Volume of Business

Considerable activity is now being shown in the buying of couplers. The market is flooded with inquiries because of the large number of double-truck car orders pending. Deferred maintenance, however, also is responsible for a large volume of orders that are being placed.

Prices are firm, no advances having been made since Dec. 1, 1919, when a small increase, approximately 5 per cent, was announced. Owing to present market tendencies, another increase about April 1 would not be a great surprise.

In addition to the couplers ordered for new cars that are being built, many railways are in the market for maintenance needs. Among the large orders for this purpose noted is one by the Brooklyn Rapid Transit Company for enough coupler heads of the pin and link type to equip 475 cars. These included 400 type 1,250 couplers, 200 type 1,275, 250 type 18 and 100 type 4-A, all of which will be furnished by the Van Dorn Coupler Company. Also the Long Island R.R. electric division, has placed an order for a large number of couplers from a well known coupler manufacturer. In addition orders from some of the railways in the larger cities are now pending and may be closed at any time. The outlook is very good for a large volume of business within the next three months.

President Names New Fuel Commission

Railroads' Coal Confiscation Claimed to Be Illegal By National Coal Association

President Wilson has issued executive orders effective until April 30 next, providing for continuation of the power of the Fuel Administration, but dividing them between the Director General of Railroads and a commission of four, composed of A. W. Howe, Rembrandt Peale, F. M. Whittaker and J. F. Fisher. It will function through the Tidewater Coal Exchange, which had been suspended before the resignation of Dr. Garfield as Fuel Administrator. Director-General Hines will retain jurisdiction over domestic distribution, while the commission will handle bunker and export coal matters. The order said the action was taken "because of the present emergency and in order to insure an adequate supply and equitable distribution, and to facilitate the movement, and to prevent, locally or generally, scarcity of coal."

It directs specifically that the order issued by the U. S. Fuel Administration Nov. 6, 1917, relative to tidewater transshipment of coal at Hampton Roads, Baltimore, Philadelphia and New York, and for the employment of and co-operation with the Tidewater Coal Exchange, as a common agency to facilitate transshipment and to reduce delays in the use of coal cars and coal-carrying vessels," suspended by Dr. Garfield on Feb. 20, 1919, be reinstated.

Rush C. Butler, the general counsel of the National Coal Association, declares that all confiscations and diversions of coal by the Railroad Administration made subsequent to Dec. 13, 1919, the date of Dr. Garfield's resignation as Fuel Administrator, are invalid and unlawful, subjecting not only the Administration itself but the individuals to liability for any damage attendant on such action.

Line Hardware Active

Spring Buying of Line Materials Opening Up Well—Railways Commence on Linework Within Six Weeks

To all appearances railways utilities are quite active in their preparations for line work this spring as orders for line hardware have been coming in in large amounts. Here and there, however, spots are found in the ordering where there is little or no work in course of preparation at this time. Throughout the South, West, and Middle West the buying has been more marked than in the East, although there has been considerable movement there too.

Shipments are of varying length of time, according to the class of material required. In the East flats may be ordered from stocks acquired before the embargoes shut down shipments from the steel regions, and deliveries are being made in two to three weeks. Many brackets are coming through in three to four weeks, while some cannot be shipped for four to six weeks.

It seems that the rolling mills are devoting much of their effort on heavy sections, and this is given as a reason for a rather limited quantity of the light sections such as angles, channels, ovals and flats.

The latter part of last week some manufacturers advanced their prices of line hardware 10 per cent, and it is expected that those who have not already done so will follow suit any day. The tendency of steel products is upward, and mills are booked to the limit for months to come. One of the main causes for the shortage is given as the insufficient number of cars to carry coal to be coked, to carry raw materials to the mills and to remove finished products from the mill warehouses. Then, too, there is a shortage of labor not only in the steel mills but also at the coke ovens, so that it is improbable just now that a considerably greater amount of coal could be coked were there sufficient cars available to bring the coal in.

Changes in Westinghouse Railway Department

Myles B. Lambert Becomes Manager and W. S. Rugg and Charles Robbins, Assistants to Vice-President

Announcement has been made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., of the appointment of W. S. Rugg, formerly manager of the railway and of the marine departments, and Charles Robbins, assistant sales manager, as assistants to vice-president. Myles B. Lambert, for many years actively connected with the work of the company, now becomes manager of the railway department.

Mr. Rugg comes from Michigan and is a Cornell graduate. Soon after his connection with the company, he was transferred from Pittsburgh to Chicago and, in 1901, was transferred to New York as special engineer. Eight years later he was made the manager of the office. In 1917, he was recalled to East Pittsburgh to take charge of the railway department where, in 1918, he was also made manager of the newly created marine department.

Mr. Robbins began his connection with the company in 1899 at its New York office. He was transferred in 1906 to the main offices at East Pittsburgh to become assistant to the manager and later manager of the industrial and power departments. In August, 1915, he was made assistant sales manager of the company.

Mr. Lambert joined the Westinghouse forces in 1901 and since that time he has occupied several positions in the railway department. The last one, previous to his promotion, was that of assistant to the manager. The larger part of Mr. Lambert's early life was spent in practical railway work. This has given him a thorough understanding of the class of work handled by his department. His earlier experiences were with the Long Island Railroad, then a steam operated road. Subsequently he entered the employ of the Kings-County Elevated Railroad of Brooklyn, where later he became division superintendent. Mr. Lambert's latest promotion will be gladly received

by those of his wide acquaintance among electric railway men. He has been particularly active in behalf of the American Electric Railway Association, serving on several of its committees.

Sheet Products Advance

Headlights, Heaters With Pressed Covers and Devices Contained in Sheet Boxes Included

Owing to an increase in the price of sheets, similar increases in the price of headlights, heaters, covering boxes for electrical devices, etc., have been announced during the past few weeks. These increases range from 5 to 7½ per cent.

Manufacturers in the railway field are experiencing great difficulty in obtaining any sheet at all. Prices are high with large premiums the rule. Orders placed with the mills mean very little as the delivery situation is indefinite and hence manufacturers do not know what they will be able to produce. Some of the more fortunate ones who have a considerable amount of stock on hand will be enabled to quote good prices on a large amount of new business that is now being offered.

Sheet mills are operating at from 70 to 80 per cent of normal. This, however, has had little effect in relieving the sheet shortage among manufacturers in the railway field as manufacturers from every field are in the market for sheets and the demand is many times greater than the supply. The car shortage, also, is proving to be a heavy drawback and even when sheets are finished, it is almost impossible to get them moved. At the present time heavy stocks of finished sheets are piled up in the sheet mills or warehouses of mills waiting for cars.

Although quotations for box annealed one-pass block sheets in from No. 17 to No. 30 gage range from $4.20 to $5.15 per 100 lb., manufacturers in the railway field have been forced to pay 8 cents to 9 cents per pound in order to continue production made necessary by the recent heavy ordering of equipment.

Chicago Plans to Buy 300 Cars

The Chicago Surface Lines is contemplating the purchase of 300 new cars during the present year. The purchase of at least 200 additional cars is practically certain, since the Public Utilities Commission has asked that more cars be put in service.

Rolling Stock

Lincoln (Neb.) Traction Company, has placed an order with the American Car Company for fifteen Birney safety cars.

Cumberland County Power & Light Company, Portland, Maine, lost two cars and a snowplow in a fire which destroyed its carhouse.

Indianapolis (Ind.) Street Railway, will be in the market shortly for from forty to fifty double-truck cars probably of the pay-as-you-enter type.

People's Gas & Electric Company, Burlington, Iowa, has ordered six safety cars from the National Safety Car & Equipment company.

New York & Stamford Railway, Port Chester, N. Y., is in the market for from five to seven safety cars.

Omaha & Council Bluffs Street Railway, Omaha, Neb., has ordered five Birney safety cars for use on four of its outlying lines.

Grand Rapids (Mich.) Railway has placed an order for nineteen safety cars. The purchase has been approved by the special street car committee of the city commission.

Interstate Public Service Company, Indianapolis Ind., has purchased an electric locomotive for use on its line between Indianapolis and Louisville.

Franchises

Hudson & Manhattan Railroad, New York, N. Y.—The application of the Hudson & Manhattan Railroad for another extension of time in which to begin building its line from Thirty-third Street and Broadway, its present terminus, to the Grand Central Terminal was denied on Feb. 28 by Acting Transit Construction Commissioner Ryan.

Track and Roadway

Calgary (Alta.) Municipal Railway.—The Calgary City Commission is considering the purchase of 100 tons of steel for proposed improvements to the line of the Calgary Municipal Railway in Tuxedo Park.

British Columbia Electric Railway, Vancouver, B. C.—The British Columbia Electric Railway proposes to extend its Mount Tolmieline, Victoria, B. C., to Bay Road.

Boston (Mass.) Elevated Railway.—The Boston Elevated Railway has announced that it will pay the entire cost

NEW YORK METAL MARKET PRICES

	Feb. 4, 1920	March 3, 1920
Copper, ingots, cents per lb.	19 00	18 37
Copper wire base, cents per lb.	22 25	22 25
Lead, cents per lb.	8.75	9.00
Nickel, cents per lb.	45.00	45.00
Spelter, cents per lb.	8.70	9.10
Tin, cents per lb.	58.00	61.50
Aluminum, 98 to 99 per cent, cents per lb.	32.50	33.00

OLD METAL PRICES—NEW YORK

Heavy copper, cents per lb.	17.75 to 18.00	17.00 to 17.50
Light copper, cents per lb.	15.50 to 16.00	14.75 to 15.25
Heavy brass, cents per lb.	10.00 to 10.50	9.50 to 10.25
Zinc, cents per lb.	5.00 to 5.25	5.00 to 5.25
Yellow brass, cents per lb.	8.50 to 9.00	9.00 to 9.25
Lead, heavy, cents per lb.	6.75 to 7.00	7.50 to 7.75
Steel car axles, Chicago, per net ton.	$33.00 to $35.00	$31.00 to $32.00
Old carwheels, Chicago, per gross ton.	$35.00 to $36.00	$41.00 to $42.00
Steel rails (scrap), Chicago, per gross ton.	$29.00 to $30.00	$30.50 to $31.00
Steel rails (relaying), Chicago, gross ton.	$34.00 to $35.00	$34.00 to $35.00
Machine shop turnings, Chicago, net ton.	$14.50 to $15.00	$17.50 to $18.00

ELECTRIC RAILWAY MATERIAL PRICES

Rubber-covered wire base, New York, cents per lb.	30.00	30.00
Waterproofed wire (100 lb. lots), cents per lb., New York	27.50	27.50
Weatherproof wire (100 lb. lots), cents per lb., Chicago	27.00	27.00
T rails (A. S. C. E. standard), per gross ton	$55.00 to $57.00	$55.00 to $57.00
T rails (A. S. C. E. standard), 20 to 500 ton lots, per gross ton	$51.00 to $53.00	$55.00 to $57.00
T rails (A. S. C. E. standard), 500 ton lots, per gross ton	$45.00 to $47.00	$45.00 to $47.00
T rail, high (Shanghai), cents per lb.	3.00	3.00
Rails, girder (grooved), cents per lb.	3.00	3.00
Wire nails, Pittsburgh, cents per lb.	4.50	4.00 to 4.50
Railroad spikes, drive, Pittsburgh base, cents per lb.	3.35 to 3.85	3.35 to 3.85
Railroad spikes, screw, Pittsburgh base, cents per lb.	7.50 to 9.00	7.50 to 9.00
Tie plates (flat type), cents per lb.	3.00	3.00 to 4.00
Tie plates (brace type), cents per lb.	3.00	3.00 to 4.00

ELECTRIC RAILWAY MATERIAL PRICES

	Feb. 4, 1920	March 3, 1920
Tie rods, Pittsburgh base, cents per lb.	7.00	3.50 to 4.25
Fish plates, cents per lb.	3.00	3.50 to 4.25
Angle plates, cents per lb.	3.90	2.75 to 4.00
Angle bars, cents per lb.	3.90	2.75 to 4.00
Rail bolts and nuts, Pittsburgh base, cents per lb.	4.50 to 6.50	4.50 to 6.50
Steel bars, Pittsburgh, cents per lb.	3.00 to 4.00	3.00 to 5.00
Sheet iron, black (24 gage), Pittsburgh, cents per lb.	4.35 to 4.60	4.50 to 7.00
Sheet iron, galvanized (24 gage), Pittsburgh, cents per lb.	5.75 to 5.95	6.00 to 8.00
Galvanized barbed wire, Pittsburgh, cents per lb.	4.10 to 4.45	4.60
Galvanized wire, ordinary, Pittsburgh, cents per lb.	3.70 to 3.95	4.20
Car window glass (single strength), first three brackets, A quality, New York, discount †	77%	77%
Car window glass (single strength), first three brackets, B quality, New York, discount	77%	77%
Car window glass (double strength, all sizes AA quality), New York, discount.	79%	79%
Waste, wool (according to grade), cents per lb.	20 to 23	29 to 32
Waste, cotton (100 lb. bale), cents per lb.	19 to 22	16 to 17
Asphalt, hot (150 tons minimum), per ton delivered	.....	.....
Asphalt, cold (150 tons minimum, pkgs. weighed in), per ton	$25.00	$25.00
Asphalt filler, per ton	$30.00	$30.00
Cement (carload lots), New York, per bbl.	$2.90	$2.90
Cement (carload lots), Chicago, per bbl.	$2.00	$2.00
Cement (carload lots), Seattle, per bbl.	$2.68	$2.68
Linseed oil (raw, 5 bbl. lots), New York, per gal.	$1.93	$1.80
Linseed oil (boiled, 5 bbl. lots), New York, per gal.	$1.95	$1.82
White lead (100 lb. keg), New York, cents per lb.	14½	15½
Turpentine (bbl. lots), New York, cents per gal.	$1.97	$1.99

† These prices are f. o. b. works, with boxing charges extra.
* U. S. Steel Corp.

of the relocation of the tracks in the Belgrade Avenue extension. The company had previously contended that the Eastern Massachusetts Street Railway should pay part of the cost of the work.

New York & Queens Traction Corporation, Brooklyn, N. Y.—Action of the New York City Board of Estimate in ordering the Manhattan & Queens Traction Corporation to construct a surface line from Jamaica to the corporate limits of the city of New York has been validated by Judge Henry W. Rogers of the United States Circuit Court of Appeals in an opinion in which he reverses the recent decision of Judge Thomas I. Chatfield of the United States District Court sustaining an injunction against the Board of Estimate.

Chickasha (Okla.) Traction Company.—This company is building 3,000 feet of track.

Toronto (Ont.) Civic Railway.—Plans have been submitted to the Civic Administrative Commission by the Toronto Civic Railway of Toronto for the construction of an incline railway at a cost of $180,000.

Scranton (Pa.) Railway.—The Scranton Railway plans to elevate its tracks at North Main Avenue and 100th Street.

Grand Trunk Railroad, Montreal, Que.—The Grand Trunk Railroad plans to electrify its St. Mary's, Ont., branch. Work will begin shortly.

Milwuakee Electric Railway & Light Company, Milwaukee, Wis.—Plans are being worked out for the construction of a car line from Kinnickinnic Avenue to the city limits.

Power Houses, Shops and Buildings

Pacific Electric Railway, Los Angeles, Cal.—The Pacific Electric Railway has begun the construction of a $75,000-dollar passenger station in San Pedro.

Tri-City Railway of Illinois, Rock Island, Ill.—The Tri-City Railway of Illinois and the Moline, Rock Island & Eastern Traction Company have filed a joint petition with the Illinois Public Utilties Commission asking for approval of the purchase by the first named company of the tracks and equipment of the latter.

Terre Haute, Indianapolis & Eastern Traction Company, Indianapolis, Ind.—This company is making plans for dismanteling its power station at Lebanon, Ind. and substituting a high-tension line from another power house. There is also a general study being made looking toward a change from twenty-five to fifty cycles on part and perhaps all of the system, in order to be in better position to sell energy for commercial purposes.

Cumberland County Power & Light Company, Portland, Me.—A carhouse belonging to the Cumberland County Power & Light Company at Yarmouth was destroyed by fire on Feb. 14. Two cars, a snow-plow and a rotary converter were also destroyed. The loss is estimated at $50,000.

Trade Notes

American Steel & Wire Company, Worcester, Mass., has started work on a new Labor Bureau building to cost $75,000.

Charles A. Hirschberg, advertising councillor, specializing in the technical field, announces that he is now located at 426-436 Sun Building, 150 Nassau Street, New York.

Westinghouse Electric International Company, Pittsburgh, Pa., announces that G. L. Washington has left for Cuba to join the sales department of the Havana office of the company.

Roth Brothers & Company, 14 W. Adams Street, Chicago, Ill., motor manufacturers, announce that H. E. Stocker for a number of years production manager of the Fort Wayne Works, General Electric Company, has become general manager of the company.

American Steam Conveyor Corporation, Chicago, Ill., announces that Henry P. Thompson, Cincinnati district representative of the company has added to his sales engineering staff. Albert A. Casey, who will assist in handling American steam jet conveyors in that territory.

Lindsley Brothers Company, Spokane, Wash., with offices in the Hudson Terminal Building, 50 Church Street, New York, N. Y., announces that R. D. Patterson formerly with the Northwestern Electric Equipment Company, New York City, has been appointed eastern representative of this company.

Western Electric Company, New York, N. Y., announces that J. F. Davis who has been a supply salesman at Chicago for a number of years and has been with the company since 1911, has now been made sales manager at the Boston branch, the position recently held by W. F. Abely, who was promoted.

American Institute of Electrical Engineers and the Association of Iron and Steel Electrical Engineers held a joint technical session at the Hotel Chatham, Pittsburgh, Pa., on Saturday, February 21, at which time a paper was presented on the "Manufacture and Use of Graphic Recording Instruments" by Professor J. W. Esterline, of the Esterline Company, Indianapolis.

Graton & Knight Manufacturing Company, Worcester, Mass., manufacturers of leather beltings, has purchased the leather belting plant of E. R. Ladew Inc., Glen Cove, New York. According to reports several millions was involved in the deal. The main factory at Glen Cove, N. Y., has been established since 1903.

Anaconda Copper Mining Company, Chicago, Ill., rolling mills department, announces that Frank H. Freeman has been appointed sales agent of the general office of the rolling mills department, Chicago. He was formerly connected with the Boston office of the American Electrical Works. H. Don Keresey, sales agent rolling mills department, has been transferred from the Chicago office to the New York office as sales agent to handle the company's business in the eastern territory.

New Advertising Literature

De Pere-Burton Company, Milwaukee, Wis.: A thirty-two-page loose-leaf catalog on the Burton semi-sectional and De Pere improved cross-dam water tube boilers.

National Tube Company, Pittsburgh, Pa.: Bulletin 24A; 8½ x 11 in.; illustrated. Statistical data noting comparisons in the production of wrought and steel pipe.

Griscom-Russell Company, 90 West Street, New York, N. Y.: Bulletin No. 311 on Reilly Evaporators of the submerged type and a paper on "High Heat Level Evaporator Plant" for stationary power houses.

Green Engineering Company, East Chicago, Ind.: A thirty-two-page booklet "Securing Better Combustion of Midwest, Western and Southwestern Fuels" which consists of a compilation of articles which have appeared in McGraw-Hill publications during the past year.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.: A 36-page booklet, "Westinghouse Underfeed Stoker," on stoker operation, giving features of design, grate and tuyeres construction and also the arrangement of brackets, gears and fuel deflecting plates.

Carrick Engineering Co., Chicago, Ill.: A twelve-page catalog, letter size, describing the Carrick Combustion Control which automatically synchronizes fuel feed and damper position to correspond with the load, holding the proper relation for efficient results. A copy of the catalog will be sent upon written request.

Coatesville Boiler Works, Coatesville, Pa.: A sixteen-page booklet "Fuel Oil Applied to Power Boilers." It contains some valuable information as to the relative merits of different fuels for use under boilers of all types, as well as on the dimensions and capacity in gallons of horizontal and vertical storage tanks. A copy may be had free upon request.

Baldwin Locomotive Works, Philadelphia, Pa.: Record No. 95 on Internal Combustion Locomotives. A 36-page illustrated booklet describing this company's gasoline locomotives built in accordance with the Ehle patents. The general construction with details of the various parts are described and illustrated. A number of illustrations taken from locomotives in service including those made for the Government are shown. Data sheets for inquiry giving general requirements also are included.



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PEACOCK STAFFLESS BRAKE
saves
PLATFORM SPACE

The working parts of the Peacock Staffless are inclosed in a solid Pressed Steel case which projects into the vestibule only 3¼ inches. It is

NEAT, LIGHT and POWERFUL

The Peacock Staffless brake weighs no more than the ordinary vertical wheel and staff. It occupies about one-half the space and yields three times the power.

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Byllesby Engineering & Management Corporation
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Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS

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Baltimore, Md.	Continental Trust Building	Duluth, Minn.	Wolvin Building
PITTSBURGH, PA.	Frick Building	Minneapolis, Minn.	7th Ave. & 2nd St., S. E.
Buffalo, N. Y.	Marine National Bank		
Cincinnati, Ohio	Union Trust Building	*Pacific Coast Representative:*	
Atlanta, Ga.	Candler Building	U. S. Steel Products Co., Pacific Coast Dept.	
Cleveland, Ohio	Guardian Building	San Francisco, Cal.	Rialto Building
Detroit, Mich.	Beecher Ave. & M. C. R. R.	Portland, Ore.	Selling Building
CHICAGO, ILL.	208 South La Salle Street	Seattle, Wash.	4th Ave. So., Cor. Conn. St.

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The result of the best practice in electric railway work is recorded every week in the Electric Railway Journal.

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Surplus $1,000,000 Und. Profits $363,051
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Offers to dealers every facility of a New York Clearing House Bank.

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attained by the expert, but maintained by the ordinary operator



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Since it is a demonstrated fact that clinkers cannot form, no stops for cleaning fires of clinker are necessary and no steam-consuming auxiliaries are needed for dumping clinker and keeping accretion of clinker from growing on the side and bridge walls.

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The only true test of a stoker is its net efficiency; and every installation offers direct evidence that Green Chain Grates survive this practical test.

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Driving engine requires but 30 lb. of steam per hour for the largest stoker—no other steam consuming auxiliaries—all efficiency figures quoted are net.
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for railway shop, power plant and rolling stock



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The Enduring Lubricant for Turbines

It does not emulsify nor form deposits of any kind and frees itself from any moisture entering the system. It supplies a constant stream of clean, cooling oil to the bearings at all times. It maintains a uniform quality over long periods of time. Texaco Regal Oil is one of the many Texaco Lubricants for a specific purpose.

There is a Texaco Lubricant for Every Purpose

Texaco Lubrication Engineers will gladly assist you in selecting the right Texaco Lubricants for your shop—Power Plant, Rolling Stock or any other equipment you operate. You may call upon them to make a survey of the equipment if necessary. This is Texaco Service. There is no charge.

THE TEXAS COMPANY

Dept. RJ, 17 Battery Place, New York City
New York Chicago Houston
Offices in Principal Cities



Let us send you our magazine "Lubrication" each month. It is full of good stuff and free for the asking. Write today telling us to put your name on our mailing list.



Badmash



According to Hindu belief the wife of one king was carried off by another demon king and was so guarded that humans couldn't rescue her.

Hanuman, a monkey, got on the job, rescued the fair queen and was immortalized as a badmash, or hero.

Monkey antics won out this time, but it was only in mythology. In real life—especially as applied to carbon brushes—monkeying with things invariably gums the cards.

But engineering, as employed in prescribing Morganite brushes, relieves operators from monkeying with brushes or commutators—and the resulting gloss on the commutator is far removed from a monkey shine.

Morganite

The Morgan Crucible Company

Main Office and Factory
519 West 38th St., New York

DISTRICT AGENTS:

Lewis & Roth, 13th and Wood Sts., Philadelphia
Electrical Engineering & Mfg. Co.,
First National Bank Bldg., Pittsburgh
W. L. Rose Equipment Co., La Salle Bldg., St. Louis
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Herzog Electric & Engineering Co., 150 Steuart St.,
San Francisco
Charles Farnham, I. W. Hellman Bldg., Los Angeles
Railway & Power Engineering Corporation, Ltd.,
131 Eastern Ave., Toronto, Ontario, Canada



Toledo Means —*Efficiency*

whether it comes to coal handling or picking up motors, trackwork and trucks in the repair or construction shop. Toledo means care in design and construction, which insures speedy operation *for years* without delays or more than normal maintenance costs.

The Toledo Bridge & Crane Co.
Toledo, Ohio

Birmingham Office, 1011 Empire Bldg.; Boston Office, 141 Milk Street; Buffalo Office, 610 Iroquois Bldg.; Chicago Office, 549 Washington Blvd.; Cincinnati Office, 414 Elm Street; Cleveland Office, 735 Citizens Bldg.; Kansas City, Mo., Office, Finance Bldg.; Minneapolis Office, 1124 Metropolitan Life Bldg.; New York Office, 52 Broadway; Philadelphia Office, 1063 Real Estate Trust Bldg.; Pittsburgh Office, 703 Oliver Bldg.; San Francisco Office, Rialto Bldg.; St. Louis Office, Federal Reserve Bank Bldg.; Salt Lake City Office, 17 Exchange Place; Seattle Office, Hoge Bldg.

International Fare Registers Meet Every Need



Type R-5—Double Register



Type R-10—Single Register

Odd-cent fares, or frequent changes of rates impose no difficulties in the use of International Registers. No matter what the change in fare, the collection system is still complete and entirely effective, without changes or adjustments.

Fare registers, operated by the conductor and counting passengers instead of money, provide a flexible system for positively checking the load and the receipts. Visible and audible registraton so necessary to an entirely effective fare collection system are best provided by International Registers.

Long service has demonstrated their absolute relability of registration, and long continued service with minimum repair costs. All parts are interchangeable and needed repairs can be easily made.

International Fare Registers are made in models and sizes adaptable to all classes of service.

Our organization is at your service to help with your problems.

The International Register Company

Manufacturers of Fare Registers and Railway Supplies, and General Selling Agents for
HEEREN ENAMEL BADGES

Office and Factory: 15 So. Throop Street, Chicago, Illinois



Car Space
Value is gauged
by Car Card Value

Collier Service

Maintains the Value of Both

Collier Service covers every nook and corner of the country so well that no matter how small or how large an advertiser is, service of the highest quality is rendered.

This means satisfied advertisers and it is only through the steady and uninterrupted support of satisfied advertisers that the stability of car space is maintained as a source of revenue to the railway company.

Barron G. Collier

Candler Building, New York



An Ohmer operating equipment adapted to either pay-within, pay-as-you-enter one-man, or two-man operation

Make Fare Protection Certain

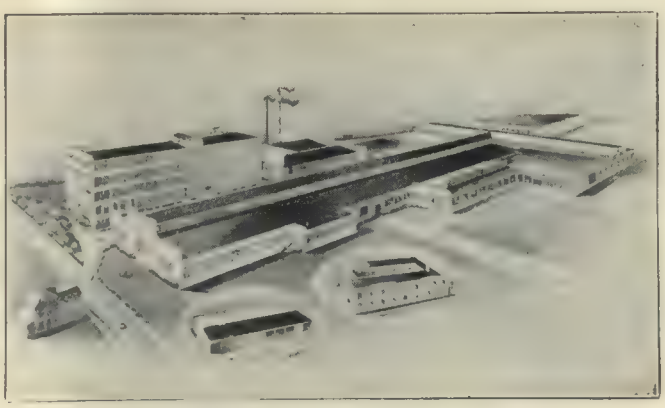
The Ohmer Fare Register is a basic invention. So is the telephone and the telegraph. While these devices are being improved continually to meet the complex needs of the present day, the principles involved in their use remain the same.

The Ohmer Fare Register is as necessary to the electric railway operator as double entry bookkeeping is to the storekeeper. It is the logical means of making proper records of the fares at the proper time and classifying all the details in connection with the income.

If you are not absolutely sure of your fare protection methods, if you have the least suspicion that everything is not quite right, let us know about it.

We are constantly in touch with the most careful and successful railway men on the North American Continent. We are continually studying and solving new and unusual problems for our clients and we stand ready to help you.

OHMER FARE REGISTER CO.
DAYTON, OHIO



The Home of the Ohmer Fare Register



Up-to-date Equipment for the Safety Car

Just as the Safety Car is up-to-date equipment in itself so you should have equipment on the Safety Car that is up-to-date.

Agasote Roofing, Headlining and Wainscoting,
(Trade-Mark)
Pantasote Curtains.
(Trade-Mark)

THESE products go a long way toward making the Ideal Safety Car.

Agasote for roofing will outwear wood many times. It is absolutely waterproof to start with and it stays that way.

In case of accident it is easily and rapidly patched.

Old-fashioned Curtains wear out quickly. They are made of flimsy material, easily torn, stained and discolored.

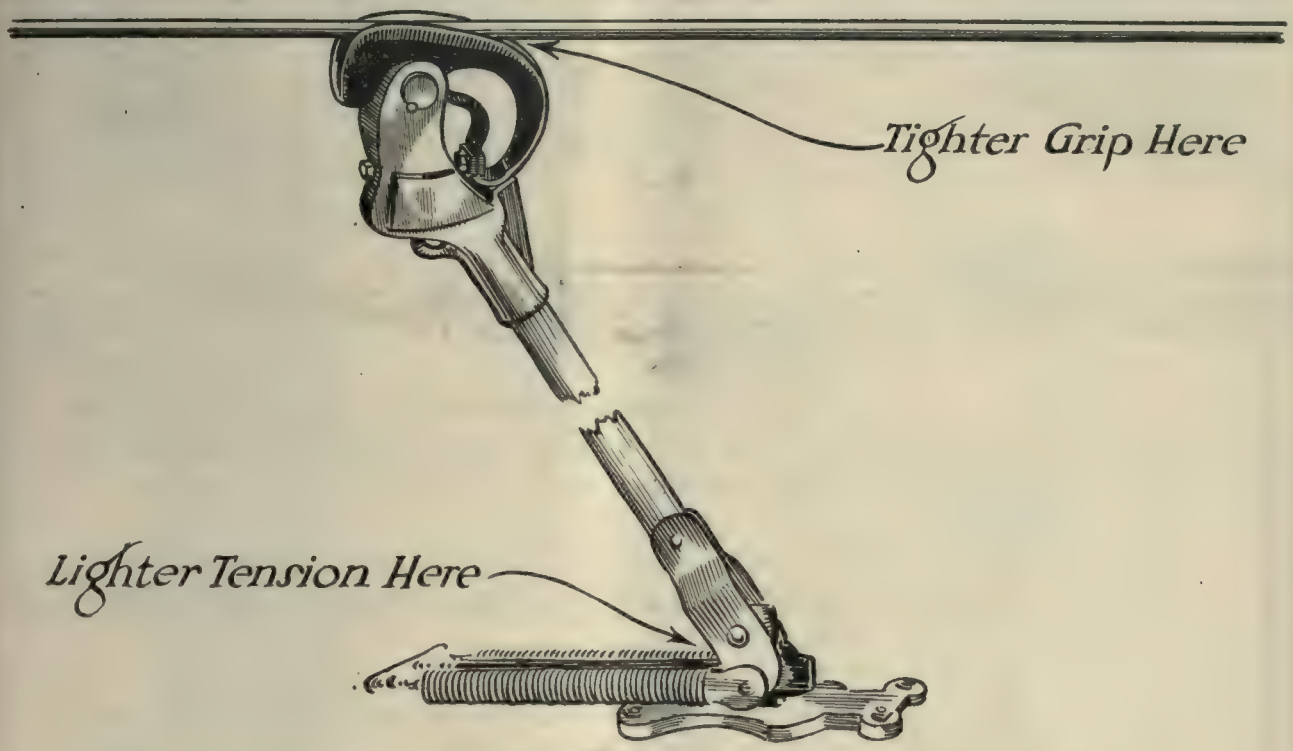
Pantasote Curtains wear a great many times longer; are made tough and not easily torn. When washed they look as good as new.

Agasote and Pantasote save you money and are essential for the Ideal Safety Car.

THE PANTASOTE COMPANY

11 Broadway, New York People's Gas Bldg., Chicago, Ill. 751 Monadnock Bldg., San Francisco, Calif.

MILLER TROLLEY SHOES MEAN



It seems absurd to say that a connection takes a tighter grip on the wire and permits of a lesser tension on the base.

But this is true where Miller Trolley Shoes are used because they have such a large contact surface.

Miller Trolley Shoes are always in contact with the wire, at all speeds.

Decreased tension on the base means less wear on the wire. A greater contact surface means better transmission of power.

Miller Trolley Shoe Co., West Newton, Mass.

SPECIAL REPRESENTATIVE: Holden & White, Inc., Chicago

EASTERN REPRESENTATIVE: National Railway Appliance Co., New York

SALES REPRESENTATIVES:

Alfred Connor, Denver, Colo.
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F. F. Bodler, San Francisco, Calif.
W. M. McClintock, St. Paul, Minn.
S. I. Wailes, Los Angeles, Calif.
W. F. McKenney, Portland, Oregon.



Quality Trolley Wheels and Harps

Like all other Columbia products the trolley wheels and trolley harps manufactured by us have as their motto Quality.

Quality first, last and always. This means to our customers that they can be assured the best the market can afford.

Our wheels and harps are made of the very best metals that can be obtained. Special attention has been given to get long wear and good lubrication. This means the elimination of high maintenance and numerous tie ups due to defective trolley harps and wheels.

Let us hear from you. We want to help you.

Columbia Machine Works & Malleable Iron Co.

Atlantic Ave. and Chestnut St.

Brooklyn, N. Y.

A. A. GREEN, Sales Mgr.,
50 Church St., N. Y. C.

J. L. WHITTAKER,
141 Milk St., Boston, Mass.

TOOLS

Armature and axle straighteners
Armature shaft straighteners
Armature buggies and stands
Babbitting molds
Banding and heading machines
Car hoists
Car replacers
Coil taping machines for armature leads
Coil winding machines
Pinion pullers
Pit jacks
Signal or target switches
Tension stands

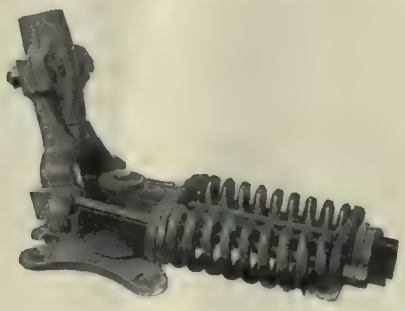


CAR EQUIPMENT

Armature and axle bearings
Armature and field coils
Bearings (axle and armature)
Brush-holders and brush-holder springs
Brake, door and other handles
Brake forgings, riggings, etc.
Car trimmings
Commutators
Controller handles
Forgings of all kinds
Gear cases (steel or malleable iron)
Grid resistors
Third-rail shoe beams and accessories
Trolley poles (steel) and wheels

One-Man Car Equipment











Phosphor bronze trolley wheels whose web design and accurate machining give the necessary strength and resistance to wear together with the light weight demanded by the quick-service car.

The tempered steel springs of the 15-C trolley base are all designed and tested to supply a wheel pressure in excess of what is needed—an adjusting device permits raising or lowering the wheel pressure at will.

Helical Gears are a proven and an acknowledged success. When these gears are BP treated, reliable, Quick-Service Car Operation is assured. Also quietness results from smoothly meshing gears.

Helical gear efficiency is high.

BP treatment makes a gear last four times as long as untreated cast steel gears in identical service.

R. D. NUTTALL CO., Pittsburgh, Pa.

MEMBER OF AGMA

Nuttall Helical Gears

A PROVEN SUCCESS





—perfect lubrication plus maximum conductivity

This combination makes V-K Oilless Trolley Wheels lowest in ultimate cost and highest in net efficiency. Examine the construction of V-K Wheel and you'll see why. Notice that it's properly balanced and mechanically perfect in finish. The metal from which it is made is specially tough but not hard. This means greater mileage and at the same time least detriment to overhead construction. The patented Oilless (graphite and bronze gauze) bushing is non-insulating, heat-proof, long-lived, easy interchangeable.

The V-K trolley-wheel used with the V-K non-arcing harp will do more to reduce trolley maintenance cost (both wheel replacements and overhead repairs) than any other current collector on the market today.

A trial will convince you as it has hundreds of other executives in charge of operation and maintenance. Write for particulars and a free copy of our latest catalog.

V-K OILLESS TROLLEY WHEEL and NON-ARCING HARP

More-Jones Brass & Metal Co.

St. Louis, Missouri

Manufacturers of

Trolley Wheels and Harps, Contact Springs, Motor Axle Bearings, Armature Bearings, Truck Journal Bearings, Air Compressor Bearings, Armature Babbitt Metal and similar products.


DOMINION OF CANADA
NOVA SCOTIA
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GEORGIA
MISSISSIPPI
ALABAMA
LOUISIANA
FLORIDA
NEW YORK
PENNSYLVANIA
MAINE
MASS
CONN
MARY
49
The map above shows the location of the 49 foundries in the United States and Canada represented by the Association of Manufacturers of Chilled Car Wheels.
Chicago 3
St Louis 2
Buffalo 4
Pittsburg 2
Cleveland 2
Amherst N.S.
Montreal
Mich. City Ind.
Louisville
Mt. Vernon Ill.
Ft Wayne. Ind.
Birmingham
Atlanta.
Savannah
Boston
Detroit
St. Paul.
Kansas City Kan
Denver
Tacoma
Los Angeles
Rochester N.Y.
Sayre. Pa.
Lime Rock. Conn
Albany.
Toronto.
New Glasgow N.S.
Madison. Ill
Berwick Pa
Huntingdon. W.Va.
Wilmington Del
Houston Tex
Hannibal Mo
Reading Pa
Baltimore
Richmond Va.
Ft William Ont.
St Thomas "
Hamilton "
Ramapo. N.Y.
Marshall. Tex
Capacity
20,000
CHILLED
IRON WHEELS
Per Day
25 Million in Service
Association of Manufacturers
of Chilled Car Wheels
1229 McCormick Bldg. Chicago

"STANDARD"

Steel Tires

Steel Tired Wheels

Solid Rolled Steel Wheels

O. H. Steel and Malleable Iron Castings

Solid Forged Gear Blanks

Steel Forgings Iron Forgings

Forged and Rolled Steel

Pipe Flanges

Ring Dies

Rings

Roll Shells Steel Springs



"The 'Standard' Brand on your material is an assurance of eventual economy."



STANDARD STEEL WORKS CO.

GENERAL OFFICES:

500 NORTH BROAD ST., PHILADELPHIA, PA.

CHICAGO
ST. LOUIS
HAVANA, CUBA

RICHMOND
SAN FRANCISCO
NEW YORK
MONTEREY, MEX.

MEXICO CITY
LONDON, ENGLAND
PARIS, FRANCE

For the "Rainy" Day

Like the man who wouldn't have his roof repaired in clear weather, because it didn't leak when it wasn't raining, you will find that the damage done when the rain comes will cost you more than the repair work.

Prepare for the "Rainy" day by ordering your supply parts now and not when your cars are idle waiting for supply parts.

The Quality Shops make Quality parts.

Keep the smile on your face by an order well placed.

St. Louis Car Company

St. Louis, Mo.

ROEBLING ELECTRICAL

We make with strict attention to quality of materials and workmanship:

Trolley Wire
Wire Strand
Welding Wire
Weatherproof Wire
Car Wire and Strand

Power Cables Rubber Covered, Paper Covered, Cambric Covered

WIRES AND CABLES

John A. Roebling's Sons Co.
Trenton, N. J.

Branches:
New York Boston Chicago Philadelphia Pittsburgh Cleveland Atlanta San Francisco Los Angeles Seattle Portland, Ore.

He *Can't* Miss It!



It's BIG —and *Reliable*

and can be *seen* so as to give your motormen plenty of time to bring the car to a stop—avoiding what might be a fatal accident at a sharp curve or switch.

U. S. Electric Signals

will be so installed on your road that the first car to reach a cut-in contactor, will have the right of way against opposing cars—preventing side-swiping accidents and providing front and rear protection as well.

"Prevent" instead of "cure." Start now. Write for particulars.

United States Electric Signal Company
West Newton, Massachusetts

Representatives:
Western: Frank F. Bodler, Monadnock Bldg., San Francisco
Foreign: Forest City Electric Service Supply Company, Salford, Eng.

OKONITE
TRADE MARK
REG. U. S. PATENT OFFICE.

VARNISHED CAMBRIC
Wires and Cables

are made with the same care and high regard for quality which distinguishes the production of Okonite rubber insulation.

We are prepared to handle any high grade proposition, and solicit your inquiries.

"Manson" Tape (Friction) "Okonite" Tape (Splicing Compound)

THE OKONITE COMPANY, Passaic, New Jersey
Incorporated 1884
CENTRAL ELECTRIC CO., Chicago, Ill., General Western Agents
F. D. Lawrence Electric Co., Cincinnati, O. Novelty Electric Co., Philadelphia, Pa. Pettingell-Andrews Co., Boston, Mass.



You Can Minimize Overhead Repair Work

and successfully cut maintenance costs if you turn to

The Macallen Line

of strain insulators, hangers, splicing ears, crossings, and other overhead material.

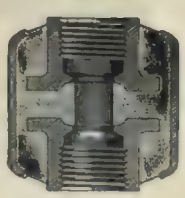
They are "specialty" products, designed and built to make "Macallen" the standard on American railways.

It will pay you to write for information and prices.



The Macallen Insulating Joint

Adopted by principal air brake manufacturers as part of their standard equipment. Also insulates steam pipes, etc. Shell is seamless drawn steel, nipples are machined from steel rod, and insulating material is Macallen Vulcanite Compound, not affected by heat or oil—practically indestructible.



May We Send Our Catalog?

TRADE MACALLEN MARK

The Macallen Company
Macallen and Foundry Sts., Boston

TRADE MACALLEN MARK

No Road!

Conductors—for electric current, for heat, for sound, and even for the capillary flow of liquids, all balk at mechanical contacts.

The motorman who gets stuck on a newly laid track drives spikes under the splice plates to "make contact."

The electric furnace man tells you that the heat never gets up past the joint in the electrode.

We all know how to deaden sound.

Red ink will climb up through a lump of loaf sugar, but not through the pile of pulverized sugar on top of the lump.

ERICO Welded Terminal Railbonds

are the bridges without which there is no road.

Inquiries for information, prices are promptly answered

THE
ELECTRIC RAILWAY
IMPROVEMENT CO.
CLEVELAND, OHIO

THERE ARE THREE VALUES FOR RAILWAY COMPANIES IN THE SPECIFICATION and USE OF

CYPRESS

"THE WOOD ETERNAL"

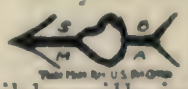
for Crossarms, Car Material, Fencing, Station Construction and similar railway purposes:

First, the vastly longer life of the material itself. *All-Heart Cypress* is pretty nearly *proof* against the action of decay.

Second, the

SAVINGS OF LABOR COSTS IN YOUR MAINTENANCE WORK

Obviously the longer the serviceable life of the lumber you use, the less you are going to have to repair and replace. That of course means not merely saving in cost of material, but also saving in the much bigger item—*cost of labor.*

Third, when you specify Cypress you can know *definitely* that you get what you pay for IF you see THIS MARK: This mark  is on the ends of every piece of Cypress cut by the responsible mills in this Association. It is a guarantee that the material bearing it is made, *and graded at the mill,* in accordance with the scrupulously high standards demanded by this Association and the best customers of its members.

These *values* are worth *getting.* The *facts* are worth *remembering.*

Our data are at your service

SOUTHERN CYPRESS MFRS.' ASS'N

1265 Hibernia Bank Building, New Orleans, La., or
1265 Heard National Bank Building, Jacksonville, Fla.



200 Safety Cars recently ordered by The Brooklyn Rapid Transit Co. will be equipped with

Westinghouse-Krantz Safety Control Panels

Safety Panels For Safety Cars

Each panel is placed above the vestibule window, within easy reach of the motorman, and carries six switches mounted in separate compartments, controlling respectively the car lights, the compressor, the heater, the headlights, the buzzer and the register. N. E. C. fuse connections for each switch are also mounted in individual compartments, which can be opened only when the switch is "off," and all reachable parts are dead.

It is impossible for the motorman to touch live parts when operating the switch.



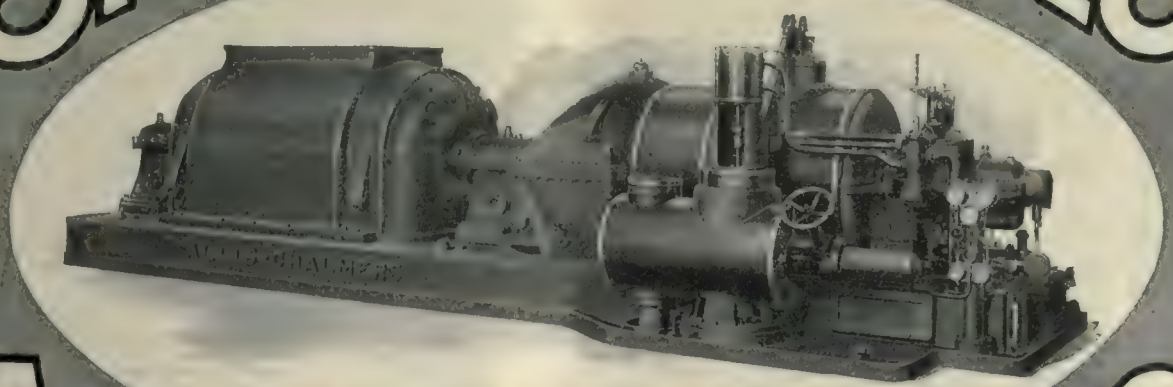
Krantz Safety Control Panel as Installed

The dimensions of the control panel are:

Length —— 30½ inches
Width —— 10 inches
Depth —— 4½ inches
The weight is 55 lbs.

Westinghouse Electric & Manufacturing Co.
Krantz Works
160 Seventh St., Brooklyn, N. Y.

STEAM TURBINES



200 K.W. to 12,500 K.W. For Efficiency and Constant Service

ALLIS-CHALMERS MFG. CO.
MILWAUKEE, WIS.

ALLIS-CHALMERS



Ebony Asbestos Wood used at South Bend, Ind., power station of the Indiana & Michigan Elec. Co.

AN engineer asked the other day, "How does Ebony Asbestos Wood compare with good oiled slate?"

We like to answer questions like that—here's what we said:

"Ebony Asbestos Wood is certainly equal, if not superior in appearance to the best oiled slate. It has much greater mechanical and dielectric strength, and it won't warp or crack. Its composition is always uniform and it's very easy to work."

"Can you prove that?" he said.

We did—he bought a switchboard. Maybe you have another use in view, but, nearly always, if slate or marble can do the job, Ebony Asbestos Wood will do it better.

Send for the booklet and see why.

JOHNS-MANVILLE
Ebony Asbestos Wood

H. W. JOHNS-MANVILLE CO.
New York City
10 Factories—Branches in 63 Large Cities
For Canada:
Canadian Johns-Manville Co., Ltd., Toronto

Through—
Asbestos
and its allied products
JOHNS-MANVILLE
Serve in Construction
Heat Insulations, High Temperature Cements, Asbestos Roofings, Packings, Brake Linings, Fire Preventive Products

In War or Peace Times—

Cut Out the Waste!

Clean up! Do it NOW! Do it regularly!

Every piece of Idle Equipment, Unnecessary Material or Scrap represents WASTE!

—waste
Money!
Time!
Space!
Labor!
Material!

—the *money* such equipment or material cost earns nothing and is not available for other use.

—the *time* it is idle is wasted when it can render service elsewhere.

—the *space* it occupies costs money and may be needed for other purposes.

—the *labor* of its manufacture is wasted and also the labor of producing a duplicate for the man who *can* use it.

—the *material* it represents would be useful in another form.

Cut out *all* this waste! Don't have material or equipment around that is not needed. Turn it into cash.

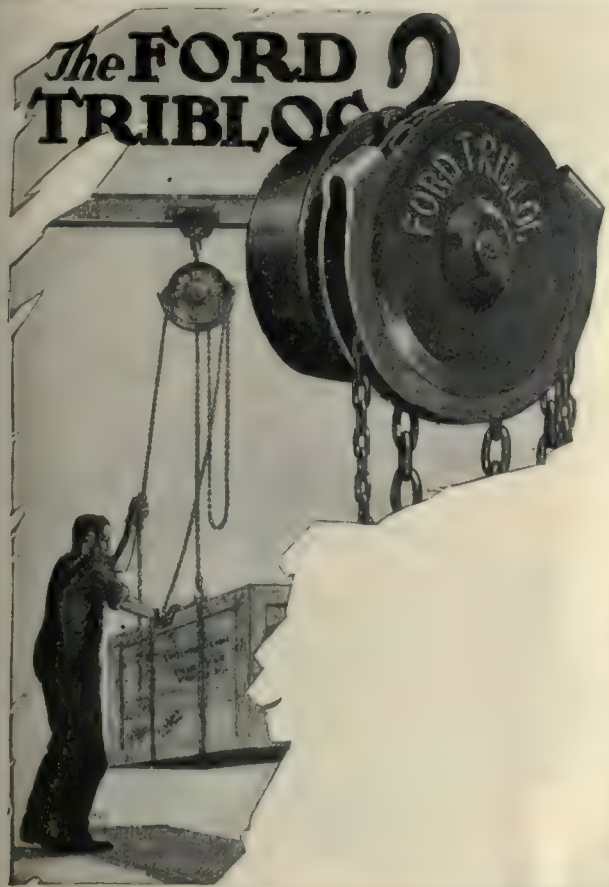
There is always a market for either scrap or good used machinery. Conservation of both materials and machinery can be practiced with just as much profit in peace as in war times.

Buyers for surplus material, good used machinery, junk or scrap, can easily be found through the

Searchlight Section

413





THE hand chain of a Ford Tribloc may be operated from any angle, at any speed, without "gagging" or over-riding the handwheel flange, because of the patented Loop Hand Chain Guide.

Ford Triblocs have the most efficient form of chain hoist mechanism yet devised—a planetary system of steel spur gearing.

Rugged construction, simple and few parts, and the very best of selected steel chain and forged steel hooks combine to make the Tribloc long-lived and safe.

Our interesting Catalog No. 3 is worth writing for.

2164-D

FORD CHAIN BLOCK CO.
2ND & DIAMOND STREETS PHILADELPHIA, PA.

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST NEW YORK U.S.A.

PARIS BRUSSELS TURIN BARCELONA RIO DE JANEIRO



Easier than Ever to Renew

Economy
Renewable
Fuses

The first renewable fuse using an inexpensive bare renewable link for restoring a blown fuse to its original efficiency to be Approved in all capacities by the Underwriters' Laboratories

—a distinction awarded December 1, 1919, on sheer merit of performance both in the rigid laboratory tests and in actual service in the field, where, for many years, millions of Economy Fuses have been protecting lives—property and electrically driven machinery of all kinds—and effecting marked economies in operating costs.

Easier than ever to renew, because of the winged washer which makes it but the work of a moment to restore a blown fuse. Simply unlock the winged washer, replace the blown Economy "Drop Out" Renewal Link, with a new one, press home the wings of the washer, screw on the end cap and the fuse is securely locked ready for continued service. Simple, easy, economical. No waste of time or money. A supply of Economy "Drop Out" renewal Links cost but little.

Economy renewable Fuses cut annual operating costs 80% as compared with the use of "one-time" fuses.

When you order fuses, simply say **"Economy"**

For sale by all leading jobbers and dealers

ECONOMY FUSE & MFG. CO.
Chicago, U. S. A.

Economy Fuses are also made in Canada at Montreal

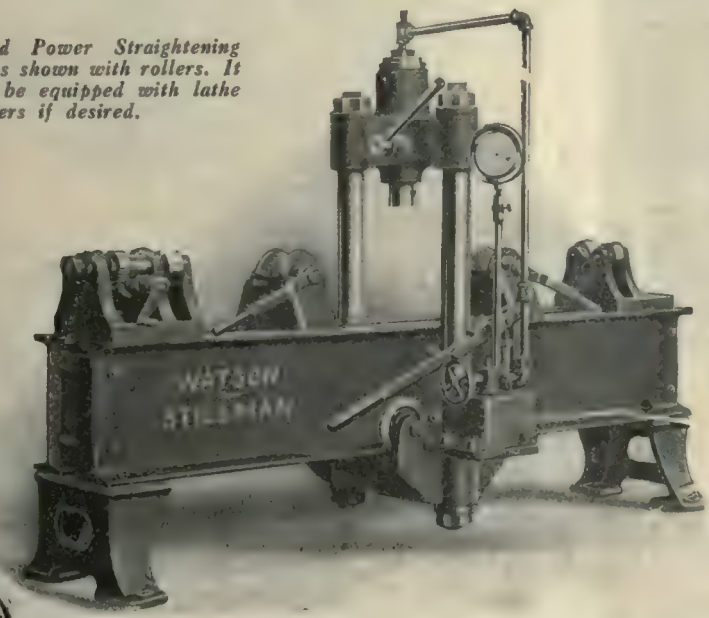
There are 17 Ry. Co's. in the U.S. operating more than 1,000 cars each

Eleven are regular users of "Tool Steel" gears & pinions

11/17 = 65 o/o.

This Press Will Straighten Your Car Axles Properly and Economically

We have furnished many railroad shops with hydraulic presses of this type for straightening axles, shafting and bars, **and for doing hundreds of odd bending jobs.**



Hand Power Straightening Press shown with rollers. It can be equipped with lathe centers if desired.

The ram has a vertical movement of 4 in. The idle portion of the stroke to and from the work is accomplished by a rack and pinion independent of the pump. The bending blocks and roller stands are adjustable to any position on the bed. The traveling frame permits a bending operation at any point between the roller frames.

We build many sizes of hydraulic benders, all as carefully designed as this machine to give the user the best service.

Write for Bulletin giving details of our big line of railway hydraulic machines including Jacks, Forcing Presses, Pit Jacks, Wheel Presses, Shears, Bending Presses, etc., etc.

The Watson-Stillman Co.
Engineers and Builders of Hydraulic Machinery
46 Church Street, New York
CHICAGO—McCormick Building

LINDALL BRUSH HOLDERS

For Improved Motor Operation

With Lindall Brush Holders, your commutators last longer. Perfect contact between brush and commutator lessens motor flashing, lengthens the life of your commutator—result—better commutation. The long sweep of the double arm compression spring allows instant response to any surface inequalities in the commutator.



Constant spring tension
No necessity for pigtails
Easy inspection of brushes
Low maintenance costs

ALL features of Lindall Brush Holders

Albert & J. M. Anderson Mfg. Co.
289-293 A Street, Boston, Mass., U. S. A.
(Established 1877)
BRANCHES:
New York, 135 Broadway
Chicago, 105 S. Dearborn Street
Philadelphia, 429 Real Estate Trust Bldg.
London, E. C., 48 Milton Street

IRVING SAFSTEP

TRADE MARK

(PATENTED) REG U S PAT OFF.

ABSOLUTELY NON-SLIPPING ALWAYS



No need for the warning "watch your step" on a car equipped with the Irving "Safstep." **You cannot slip upon it.** It is non-slipping under all conditions—wet or dry, even with snow or ice upon it. **And no amount of wear can impair its non-slipping qualities,** for its narrow steel members always present a foot-gripping edge. There are no abrasive insets to wear out or work loose. **The Irving "Safstep" is permanently safe.** Protect your company and your passengers. Write for Catalog 2A28.

Irving Iron Works Co.

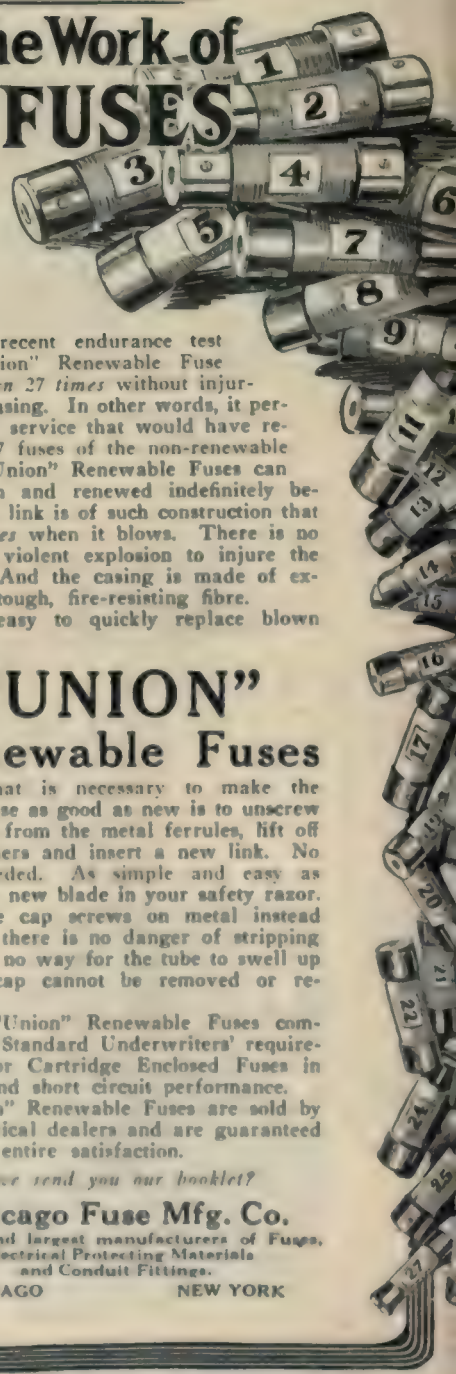
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ONE "UNION"



Did the Work of 27 FUSES



In a recent endurance test one "Union" Renewable Fuse was *blown 27 times* without injuring the casing. In other words, it performed a service that would have required 27 fuses of the non-renewable type. "Union" Renewable Fuses can be blown and renewed indefinitely because the link is of such construction that it *vanishes* when it blows. There is no flash or violent explosion to injure the casing. And the casing is made of extremely tough, fire-resisting fibre.

It is easy to quickly replace blown links in

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All that is necessary to make the blown fuse as good as new is to unscrew the caps from the metal ferrules, lift off the washers and insert a new link. No tools needed. As simple and easy as putting a new blade in your safety razor.

As the cap screws on metal instead of fibre, there is no danger of stripping threads; no way for the tube to swell up so the cap cannot be removed or replaced.

And "Union" Renewable Fuses comply with Standard Underwriters' requirements for Cartridge Enclosed Fuses in rating and short circuit performance.

"Union" Renewable Fuses are sold by all electrical dealers and are guaranteed to give entire satisfaction.

May we send you our booklet?

Chicago Fuse Mfg. Co.

Oldest and largest manufacturers of Fuses, Electrical Protecting Materials and Conduit Fittings.

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Let Us Show You—



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Let us know the size wheel you want, on what size spindle it will run, and the length of hub required. With this information we will send you all the wheels you want. If these do not live up to everything we guarantee they will cost you nothing no matter how badly they are worn.

This shows how confident we are about our wheels and it will pay you to investigate. You will find us nice people to do business with.

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Trolley Harps and Wheels for Safety Cars

Labor and Time saving are two of the advantages obtained with a one man Safety Car.

Bayonet Trolley Harps and Wheels are time savers and labor savers.

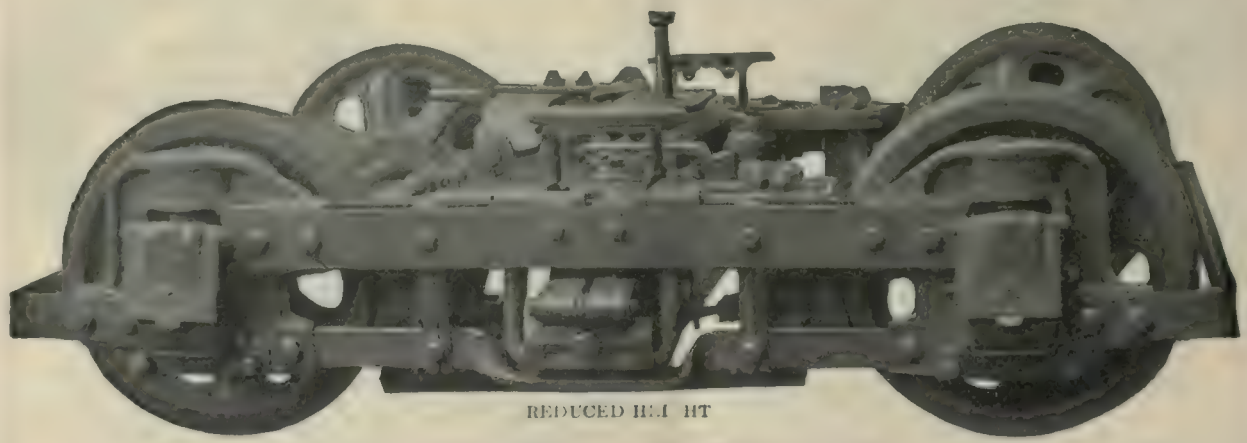
The harp or wheel can be changed in ten seconds, or a pole in less than a minute. No tools—only your hands. No delays to car schedules.

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TAYLOR R. H. TRUCK

Mounted on 26-in. Wheels with Springs Over Journal Boxes.
Designed to Mount Centre and End Entrance Cars Low Down.

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Wheel Base 5 ft. 2 in. For Car Bodies weighing 16,000 to 22,000 lb. Motors Inside Hung.

EASY RIDING

Journals 3¾ x 7 M. C. B. Type. Height from Rail to Body Bolster, 22¾ in. Brakes Inside Hung.

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SPECIFICATIONS ON REQUEST Established 1892 SEND FOR PORTFOLIO

WHICH GETS THE BEST PRICE?



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One bidder usually buys at a sale price.

A number of bidders enables the seller to get full market value.

When you have Second Hand Equipment to sell you want *all the bidders possible.*

Advertising secures more bidders.

An advertisement in *one* issue may make a sale possible but—to sell at the *best* price you must have a choice among a *number* of buyers.

A *number* of insertions will get them for you.

***BE SURE**—advertise your equipment until it is sold. Advertise it in the SEARCHLIGHT SECTION to get the **most** bidders.*

0010



IT CAN'T MOVE

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It can't move—it can't "give" nor lessen its holding power because it pulls against solid earth—not against disturbed or newly tamped ground.

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5

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About 2,000 tons of steel constantly on hand; hence prompt shipments.

Tubular Steel Poles cost 50 per cent. more than Bates Steel Poles, yet Bates Poles are 100 per cent. stronger—will last 100 per cent. longer, cover a much broader range of adaptability and are much more artistic than Tubular Poles. Ask us to verify these facts.

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Trolley Wheels
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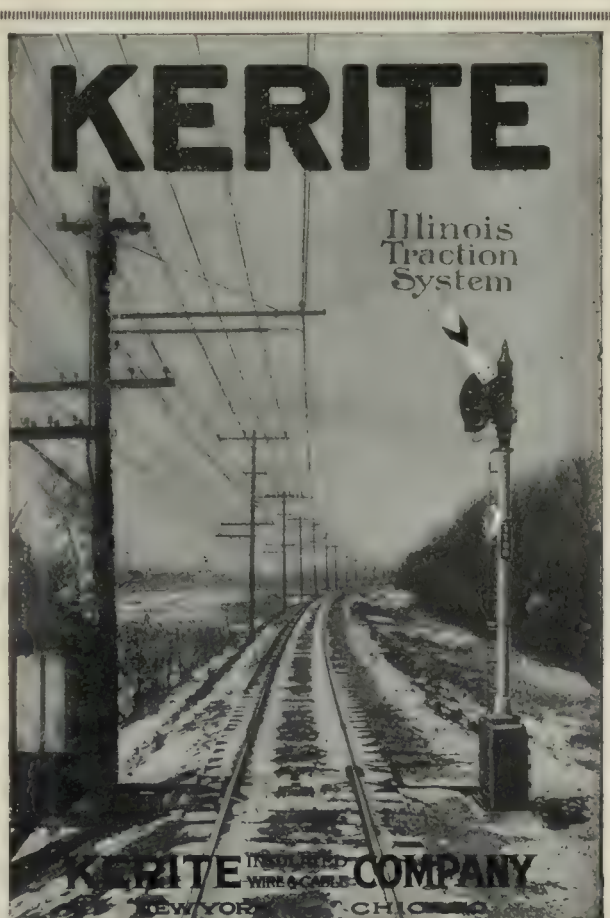
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are the insistent warnings to arrest the automobilist at your dangerous crossings. Eight-inch red lenses deeply hooded and twelve-inch bell make warnings that

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For a number of years railways have enjoyed the security and benefits resulting from this combination by installing

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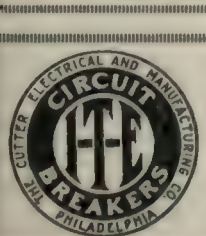
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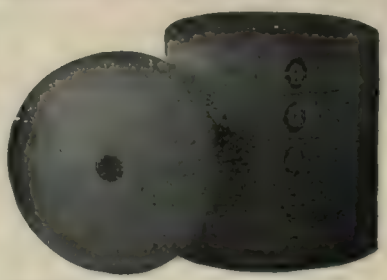
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Insurance policies *do not* put out fires. They only pay for the damage done by the fire. The delay caused by having to rebuild or repair damage done by fire often costs more than the Insurance Company pays. Avoid this delay by equipping your Power House with the *New Exclusive* CASTLE LIBERTY No. 1, a Three-Gallon Carbon Tetrachloride Type, Hand Pump Fire Extinguisher which has sufficient capacity to extinguish almost any fire apt to happen around the Power House.

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The extinguishing agent is Castle Liquid approved for Government use and used by leading Corporations, Railroads and Governmental Departments.

Write for complete description. Write for "Safety Always" telling the real story of fire extinguishing liquids.

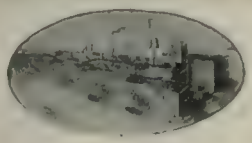
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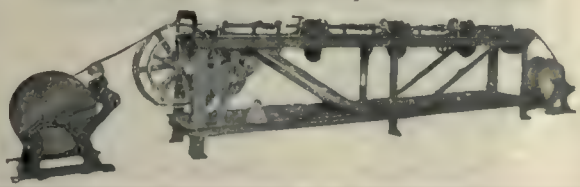
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THE ONLY SCREW HOLES IN THE WORLD

You drive the screw holes with a hammer in any material.

The screw holes are made for wood screws or machine screws to fit all sizes of screws. The head is removed and you leave a permanent screw hole.

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Manufacturers

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DEPARTMENT 14

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The Biggest Little Thing in the World

Some of the Reasons Why Screw Holes Will Be Bought and Used and Not Become Dead Stock for Anyone

1—They can be used without damage to receiving material.
2—They enable you to standardize to wood or machine screws as all material.
3—They are made of brass and will not rust under atmospheric or moisture conditions.
4—ECONOMY—They save more time value than the holes cost.
5—You get them for nothing and are paid for using them when you count time saved.
6—Screw holes have been needed ever since the first screw was used.
7—Special tools are NOT needed in using them in any material.
8—They can be used in any place a screw can be used.
9—By using screw holes screws can be used in many places, and in many materials where it is impossible to use screws without them.
10—These are the only ready-made screw holes in the world.
11—No special screws are needed. These screw holes fit any wood screw or machine screw now in stock.
12—They make the neatest possible job in any material.
13—Every store where screws are sold must carry them in stock, because the line of screws is not complete without screw holes for them.
14—Every shop and factory where screws are used must also have these screw holes to fit the screws.
15—They are endorsed by all dealers in screws and by all users of screws.
16—Screw holes are entirely new and the world supply as yet to be furnished.
17—This is a progressive Old World of ours, and every active person in it must adopt all improved methods and all new articles that will help him keep in the front line of progress.
18—Be among the first to stock up in screw holes if you are a dealer in screws.
19—Be among the first to install screw holes in your shop or factory, as you begin to save money soon as you use them.
20—In spite of the high cost of brass, screw holes are yet cheap.
21—We are letting the world know that screw holes can now be secured by means of extensive advertising in all the principal Trade Journals that have the largest circulation among dealers in screws as well as users of screws.
22—Do not let your customer ask you for screw holes before you have them in stock. BE A LIVE WIRE.
23—They make everlasting holes in any material.
24—They mean "Plug-No-More" screw holes.
25—They are the result of Necessity being The Mother of Invention.
26—Anyone who can drive a nail can use screw holes.
27—Send for a sample and convince yourself.
28—Mechanics who see them say, "What do you think of that?"
29—In fact there are NO REASONS why screw holes should NOT be used.

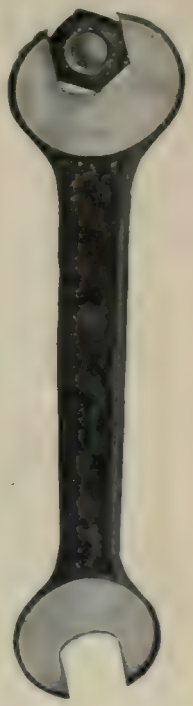
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TRADE MARK W

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The exceptional qualities of Bakelite-Dilecto are satisfying electric railways all over the country. Investigate.

Other Materials: Vulcanized Fibre—Conite—Continental Bakelite

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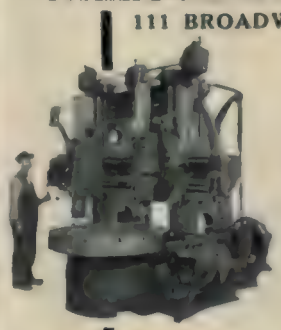
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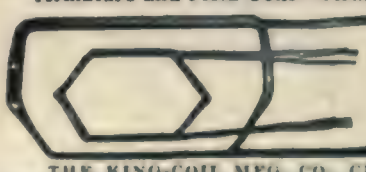


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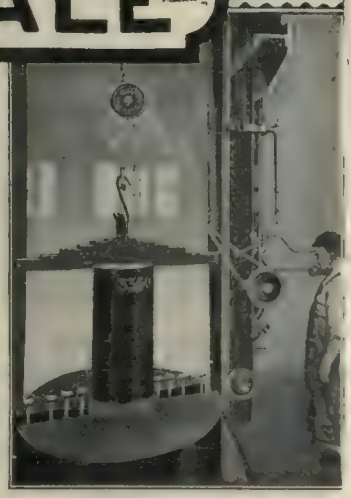
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EACH Yale Chain Block must lift a test load 50% over its rated capacity before it can leave the factory.

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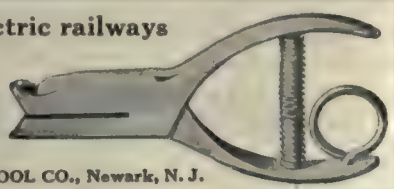
saves time, strength and trouble. The many positions to which it is adjustable easily solve perplexing lifting problems. Full details in our catalog. Write for it.



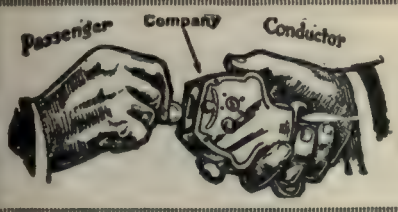
The Buckeye Jack Mfg. Co.
Alliance, Ohio

75% of the electric railways use

B-V Punches



Send for Catalog.
BONNEY-VEHSLAGE TOOL CO., Newark, N. J.



Direct Automatic Registration By the Passenger
Rooke Automatic Register Co.
Providence, R. I.



See the Crank of the
CREAGHEAD DESTINATION SIGN

By means of it, conductor or motorman can change sign without leaving platform. All that has to be done is to turn the crank. Better investigate.

CREAGHEAD ENGINEERING CO., CINCINNATI, O.

162 RAILROADS USE DIXIE CUP Penny Vending Machines
To Solve their Drinking Cup Problems in Cars and Stations



INDIVIDUAL DRINKING CUP CO.
HUGH MOORE, President
Original Makers of the Paper Cup — 220-230 W. 19th Street New York

Heating and Ventilating

Let us demonstrate to you how we can heat and ventilate your cars at the lowest possible cost

The Cooper Heater Company
Carlisle, Pa.



THE
CLEVELAND
Is the practical Fare Box for
Service at Cost
Let us tell you why
The Cleveland Fare Box Co.
Cleveland, Ohio
Canadian Branch: Preston, Ont.
1

WE CAN CUT YOUR COST OF HEATING CURRENT
Write for THERMOSTATIC CONTROL INFORMATION
GOLD
ELECTRIC HEATERS Cut Installation and Maintenance Charge.
VENTILATORS Also Ventilate in Stormy Weather.
THERMOSTATS Save Current.
ORIGINATED the use of NON-CORROSIVE Wire for Electric Car Heaters.
ORIGINATED The Ventilated Coil Support.
LET US FIGURE ON YOUR NEXT REQUIREMETNS
Gold Car Heating & Lighting Co., 17 Battery Pl., New York



The Finger Never Wears Out — The Tip is Reversible.
—and renewable. When your controllers are fitted with Triggerlock fingers, the only renewals required are the standard reversible and interchangeable tips. The finger is never scrapped unless broken through accident. Save time and money.
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We specialize in the manufacture of
HIGH GRADE
BRUSHES for RAILWAY MOTORS
and all other types of electrical equipment. All brushes especially designed for the service in which they are to operate and satisfactory performance guaranteed
Send for specification blanks
THE UNITED STATES GRAPHITE COMPANY
Saginaw, Michigan, U. S. A.
Branch Offices: New York Pittsburgh. Philadelphia Birmingham. Chicago. St Louis. Denver. San Francisco

The Kalamazoo Trolley Wheels
have always been made of entirely new metal, which accounts for their long life WITHOUT INJURY TO THE WIRE. Do not be misled by statements of large mileage, because a wheel that will run too long will damage the wire. If our catalogue does not show the style you need, write us—the LARGEST EXCLUSIVE TROLLEY WHEEL MAKERS IN THE WORLD.



THE STAR BRASS WORKS
KALAMAZOO, MICH., U. S. A.

The "Hycap-Exide" Battery for STORAGE BATTERY STREET CARS
THE ELECTRIC STORAGE BATTERY CO
PHILADELPHIA

"Boyerized" Products Reduce Maintenance
Bemis Trucks
Case Hardened Brake Pins
Case Hardened Bushings
Case Hardened Nuts and Bolts
Manganese Brake Heads
Manganese Transom Plates
Manganese Body Bushings
Bronze Axle Bearings
Bemis Pins are absolutely smooth and true in diameter. We carry 40 different sizes of case hardened pins in stock. Samples furnished. Write for full data.
Bemis Car Truck Co., Springfield, Mass.

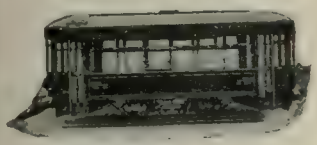
"Opportunity" Advertising:
Think *"SEARCHLIGHT"* First!
0096

DREW MOTORMEN'S SAFETY MIRRORS
Eliminate Accidents
Send for catalogue No. 18
DREW ELECTRIC & MFG. CO.
1016 E. Michigan St., Indianapolis, Ind.



Electric car heaters—thermostatic control—pneumatic car door operators—buzzers, single-stroke bells, starting signal lights—special resistances.
CONSOLIDATED CAR HEATING CO.
ALBANY, NEW YORK, CHICAGO




PERLEY A. THOMAS CAR WORKS

Manufacturer of Cars and Car Materials

Cars of all types from one-man to large interurban

HIGH POINT, N. C.

SASHES, DOORS
INTERIOR FINISH
VESTIBULES AND FRAMING

CURTAINS, VENTILATORS
SASH AND DOOR TRIMMINGS
DOOR AND STEP MECHANISM

McGuire-Cummings Mfg. Company

General Offices—111 West Monroe St., CHICAGO

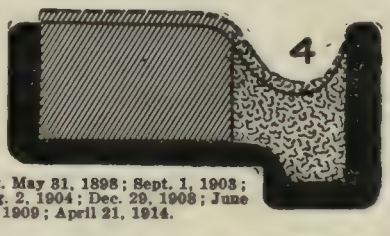
City and Interurban Cars and Trucks, Snow Sweepers and Plows,

Express, Combination and Work Cars, Electric Locomotives

Wheel Condition No. 4

When the flange only needs correction, this type of

Wheel Truing Brake Shoe



Pat. May 31, 1898; Sept. 1, 1903; Aug. 2, 1904; Dec. 29, 1908; June 15, 1909; April 21, 1914.

will do it—without jacking car up—without removing trucks—without removing car from service.

It's the economical, efficient way.

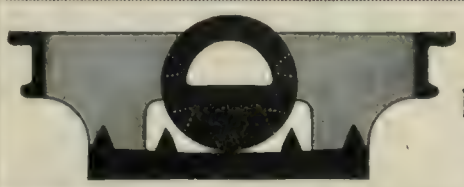
Wheel Truing Brake Shoe Co.
Detroit Michigan

PIN-AND-LINK M.C.B. CAR-AND-AIR

COUPLERS

For All Services

VAN DORN COUPLER COMPANY
2325 South Paulina Street, Chicago, Ill.



STUCKI SIDE BEARINGS

A. STUCKI CO.
Oliver Bldg.
Pittsburgh, Pa.

RAILWAY UTILITY COMPANY

Sole Manufacturers

"HONEYCOMB" AND "ROUND JET" VENTILATORS for Monitor and Arch Roof Cars, and all classes of buildings; also ELECTRIC THERMOMETER CONTROL of Car Temperatures.

141-151 WEST 22D ST. Chicago, Ill. — *Write for Catalogue* — 1328 BROADWAY New York, N. Y.

CRONKHITE



"That Close Personal Service"

MICA AND Electrical Insulation

THE CRONKHITE CO., Inc.
Boston, Mass.

Railroad and Tram Car Specialties

New inventions developed, perfected and worked for the English market

Messrs. G. D. Peters & Co., Ltd.

Windsor Works, Slough (Bucks), Eng.

Bound Brook Trolley Wheel Bushings Give Longer and Better Service

THERE are more Bound Brook (Oil-less) Trolley Wheel Bushings in use today than all other makes combined. That is because Bound Brook Bushings, by virtue of their construction, invariably outlast all other types.

All Genuine Graphited Oil-less Bushings have always been made at Bound Brook, U. S. A.

BOUND BROOK OIL-LESS BEARING COMPANY
Bound Brook, New Jersey — *Detroit Office: 1723 Ford Bldg.*

FUEL CONSERVATION

is a necessity and the heating and ventilating of street cars should be accomplished the most economical way. Our Hot Air Forced Ventilation Equipment combines heat with ventilation at a saving of 50% to 70% over electric heat.

THE PETER SMITH HEATER CO., Detroit, Mich.

SAMSON SPOT WATERPROOFED TROLLEY CORD



Trade Mark Reg. U. S. Pat. Off.

Made of extra quality stock firmly braided and smoothly finished. Carefully inspected and guaranteed free from flaws.

Samples and information gladly sent.

SAMSON CORDAGE WORKS, BOSTON, MASS.

POSITIONS VACANT

EMPLOYMENT

POSITIONS WANTED

POSITIONS VACANT

ACCOUNTANT familiar with electric railway, light and power accounts for a railway and power company in the Middle West. Give references, experience and amount of salary desired in reply. P-589, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

CAR barn foreman wanted for road operating 10 to 15 cars. Should be familiar with G. E. equipment and Westinghouse Air Brake equipment. State age, experience, references and salary expected. P-599, Elec. Ry. Journal.

ELECTRICAL draftsman for designing, detailing and layouts in connection with electrical installations in stations and substations. Reply giving age, education, experience and salary desired to Mr. H. A. Seymour, Commonwealth Edison Company, Chicago, Ill.

ELECTRICAL engineer wanted who has had a few years experience in line material construction work and who would be interested in a broader field with a manufacturing company where his experience will be of assistance. Address P-592, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

GOOD opening offered to working master mechanic who understands his business and wants to see things move. Small road operating ten cars. Location middle west. Steady place and good wages to man not afraid of work and who can produce results. Give full information and references first letter, and state wages expected. Will refund traveling expenses. P-598, Elec. Ry. Journal, Old Colony Bldg., Chicago, Ill.

JUNIOR electrical engineers, $1501—$1800. per annum for assignment to inspection of subway, elevated and street railway power houses, equipment and rolling stock. Open to those with three years' acceptable experience in electric railroading and the manufacture and installation of electrical or mechanical apparatus and to graduates in electrical engineering. A number of provisional appointments being made pending examination. Open to citizens only. Age limit 21 to 30 years. Apply to Office of Transit Construction Commissioner, Room 1195, 49 Lafayette Street, New York City.

LINE superintendent wanted. A thoroughly capable man to handle construction and maintenance for a syndicate operating in Southern Pennsylvania and Northern Maryland. During summer months to handle a gang, ten to twenty men located in various districts about three months at a time. During winter months to work on maintenance. This is an opportunity for a hustler who can handle men and materials to good advantage and offers an opportunity for advancement in a rapidly growing company. In the first letter give age, experience and references, all of which will be treated confidentially. P-591, Elec. Ry. Journal.

THREE armature winders wanted. Apply Michigan Railway Lines, Albion, Mich.

TWO experienced draftsmen wanted for steam and street railway special track work. State age, experience and salary expected in the first letter. c/o Chief Engineer, The Buda Company, Harvey, Illinois.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad. and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
533 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
531 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies.

POSITIONS VACANT

YOUNG man, experienced in construction, operation and repairs, to act as superintendent of street railway doing business of $500 per day. Prosperous company, healthful climate. Give age, experience, references and salary required. Address, Camaguey Electric Company, Camaguey, Cuba.

YOUNG man wanted, experienced in winding and repairing electric railway armatures, overhauling and wiring H. L. F. control for 1,200-volt operations. Pay 55c. per hour to start. Chance for increase. P-582, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

POSITIONS WANTED

AUDITOR. Fifteen years' experience in Electric Railway accounting. Competent office executive, available at once. Can furnish convincing references as to character and ability. Address PW579, Elec. Rway. Journal, Leader-News Bldg., Cleveland, Ohio.

AUDITOR or assistant. Seventeen years' experience electric railway and power industry. PW-583, Elec. Ry. Journal.

A COMPETENT M.M. and electrician desires position with railway company operating, city or interurbn line. Capable of handling shop, carhouse and electric equipment of plant and sub-stations. Prefer West or Southwest. PW-594, Elec. Ry. Journal, Old Colony Bldg., Chicago.

ELECTRICAL and mechanical engineering graduate, twelve years' experience, including test, central station engineering and commercial departments, with General Electric Co., chief engineer hydro-steam transmission company. Age 35, married; available immediately. PW-577, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

THREE erectors wanted for electrical equipment, such as motors, compensators, switchboards, high tension oil switch, conduit wiring, etc. Must be thorough wormen. Healthy location near Havana. We pay transportation from the States on one year's contract. State age, nationality, married or single, past experience and minimum salary wanted. Write Electrical Engineer, Hershey Corporation Central Hershey, Province of Havana, Cuba.

EMPLOYMENT superintendent for 16 years associated with one of the largest railroad properties in the country and thoroughly familiar with progressive employment methods, personnel, welfare and uniforms. Age 39 years. Desires position. PW-595, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila., Pa.

POSITIONS WANTED

ENGINEER, 32 years of age, 10 years' experience in charge of city and interurban track construction and maintenance, desires position as chief engineer or engineer of maintenance with up-to-date property. Minimum salary $3,600. Available April 1. PW-596, Elec. Ry. Journal, Old Colony Bldg., Chicago.

EXPERIENCED electric lighting and railway auditor seeks change. High grade executive. 17 years' utility, manufacturing and public accounting. Administration school graduate. Mechanically and electrically trained. Salary $4,000 to start. East preferred but not essential. PW-590, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

FOREMAN of shops and equipment, thoroughly experienced on city and high-speed interurban equipments. Form K Type M. and H. L. Control. Straight and automatic air, can produce results. Anywhere. PW-593, Elec. Ry. Journal. Old Colony Bldg., Chicago.

GENERAL superintendent of city or interurban railway. 15 years' experience on elevated, interurban and city equipment. Have successful record in handling men and can produce the best of references from present and past employers. PW-600, Elec. Ry. Journal.

SUPERINTENDENT, age 35, eighteen years' experience, transportation, mechanical and power efficiency on road operating interurban, surburban and city lines. Address PW-597, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

Your Advancement

is largely in your own hands—it is doubtful if any one else is worrying over it.

Better positions are constantly being secured through small advertisements in the "Positions Wanted" columns.

60 CENTS FOR 20 WORDS

FOR SALE

Rotary Converters

2 150 KW. Gen. Elec., type TC4A, rotary converters, 3-phase, 25 cycle, 373 v. a. c to 600 v. 250 amp. d. c.; each with 3-60 KW. type H 25 cycle 6600-375 v. oil-cooled indoor type transformers; also both a. c. and d. c. control panels with instruments, speed 750; all in fine condition, immediate shipment. Gregory Electric Co., 16th & Lincoln St., Chicago.

MISCELLANEOUS

"Move Forward, Please"

A 32-page booklet, pocket size, written by a conductor of sixteen years' experience. The author delivers a message to street railway employees, and as it comes from an equal will not be discounted. Just the thing the railway manager has been looking for in his "get together" campaigns. Sample copies 20 cents. Address John C. Connors, 302 Second Ave., Union Traction Co., Nashville, Tenn.

There is a Searchlight Section in each of the following papers:

[1] American Machinist

[2] Coal Age

[3] Electrical World

[4] Electrical Merchandising

[5] Electric Railway Journal

[6] Engineering and Mining Journal

[7] Engineering News-Record

[8] Chemical and Metallurgical Engineering

[9] Power

Each of these 9 papers is the leading periodical of the industry it serves.

Searchlight advertisements will get you in touch with the important men of these important industries.

FOR SALE

One 35-ton all-steel Monitor type 600-volt

LOCOMOTIVE

of extra heavy construction; in first-class operating condition; for delivery about March 1st.

This is a first-class machine, and is being sold only because it is not large enough to take care of increased business.

Kansas City, Kaw Valley & Western Ry. Co.
919 Baltimore Ave., Kansas City, Mo.



Armature Coil Taping Machine

Saves Time, Labor and Money

A boy can tape 40 coils for Westinghouse 12A Armature in an hour. Further particulars gladly furnished.

Geo. M. Griswold Machine Co.
NewHaven, Conn.

FOR SALE

BOILERS

2—500 H.P. B. & W. Boilers, in fair condition; water tube.

DALLAS ICE FACTORY,
Cor. Swiss and Hall, Dallas, Tex.

"Opportunity" Advertising:

Think
"SEARCHLIGHT"
First!

0099

WANTED TO BUY

TWO TRUCKS

for Fast Express Service. Must be in first-class condition. Give description, location and price.

KANSAS CITY, KAW VALLEY & WESTERN RY. CO.
919 Baltimore Ave., Kansas City, Mo.

WANTED

Four 101-B Westinghouse railway type second-hand

ARMATURES

either complete with windings or without windings.

Notify S. J. WITT, Master Mechanic, West Penn Rys. Co., Connellsville, Pa.

WANTED

1 THEW Standard Type OO or Type O Full Circle Swing

ELECTRIC SHOVEL

on Car Wheel Mounting, standard gauge; with Extension Axles and Traction Wheels; and ½-yd. Dipper; Electrical Equipment to be arranged for 550 Volts D.C.

Springfield Street Railway Company,
Springfield, Mass.

FOR SALE

FIVE

Open Trailers

FOUR

Motor Cars

For full particulars write

C. J. SWIFT
Highwood, Illinois

Some One Wants to Buy

the equipment or machinery that you are not using. This may be occupying valuable space, collecting dust, rust and hard knocks in your shops and yards.

SELL IT BEFORE DEPRECIATION SCRAPS IT

The Searchlight Section is Helping Others

—Let It Help You Also

RAILS IN STOCK

IMMEDIATE SHIPMENT

GUARANTEED

10,000 Tons New 12-lb. to 100-lb., and fastenings.
40,000 Tons New Open-hearth, first quality, 80 lb.
5,000 Tons Relayers, 25 to 100 lb., and fastenings.
Car and less carload inquiries and orders solicited.
Rails cut to lengths for all purposes.

TRACK ACCESSORIES
BOLTS, NUTS AND SPIKES

We Manufacture
FROGS, SWITCHES, CROSSINGS, PORTABLE TRACK, DUMP CARS, PLATFORM CARS, ETC.

L. B. FOSTER COMPANY
Park Building, Pittsburgh, Pa.
Tribune Building, 154 Nassau St., New York, N. Y.

Machinery in Stock for Immediate Shipment

ROTARY CONVERTERS—60-CYCLE
2—300 kw., Westg., 3-phase, 370-v., A.C., 575-v., D. C., 600 r.p.m.
1—150 kw., Westg., 2- or 3-phase, 185-v., A.C., 250-v., D.C., 720 r.p.m.

FREQUENCY CHANGER SET
1—600 kva., Allis-Chalmers Frequency Changer Set, 300 r.p.m., 3-phase, 60-cycle, 2300-v. one end, 3-phase, 6600-v., 25-cycle on other end.

ARCHER & BALDWIN, INC.
114-118 Liberty Street, New York City
Telephone, 4337-4338 Rector

Advertisements for the
Searchlight Section



Can be received at the New York Office of Electric Railway Journal until 10 a.m.

Thursday

For Issue out Saturday

0141

RAILS

1500 Tons new 90's.
500 Tons new 85's.
500 Tons new 80's.
200 Tons new 75's.
300 Tons new 70's.
300 Tons new 16's.
200 Tons new 12's.

200 Tons relay 60's.
200 Tons relay 56's.
400 Tons relay 45's.
400 Tons relay 30's.
400 Tons relay 20's.

Good Stock Immediate Shipment
New and Used Switch Material, Spikes, Bolts, Tie Plates, Rail Braces Angle Bars, Ties, etc.

ZELNICKER in ST. LOUIS

Get Bulletin No. 280—100 pages of Bargains in Cars, Locomotives, Machinery, Steel Piling, Tanks, Iron and Steel.

FOR SALE

4 Center Entrance, All-Steel Cars, Plain Arch Roof, 35 ft. over bumpers, Taylor Double Trucks.

2—G.E. 247-A Box Frame Motors.
2—K-10-P Controllers.

Complete. Splendid Condition. Full details upon request.

ELECTRIC EQUIPMENT COMPANY
Commonwealth Bldg., Philadelphia, Pa.

Caution—RAIL USERS

If you contemplate needing more track during 1920, BUY NOW. There will be a SCARCITY. We own and offer the following NEW RAILS for prompt shipment:

16-lb. Rails, angle bars, bolts and nuts
25-lb. Rails, angle bars, bolts and nuts
80-lb. Rails, angle bars, bolts, nuts and spikes
85-lb. Rails, angle bars, bolts, nuts and spikes
90-lb. Rails, angle bars, bolts, nuts and spikes
100-lb. Rails, angle bars, bolts, nuts and spikes

They will be gone soon. Write or wire for our quotations.

HYMAN-MICHAELS COMPANY
531 Peoples Gas Bldg., Chicago

BRANCH OFFICES: First National Bank Bldg., Pittsburgh, Pa.; Railway Exchange Bldg., St. Louis, Mo.; East Chicago, Ind.
YARDS AND WAREHOUSES: East Chicago, Ind. and St. Louis, Mo.

CARS FOR SALE

2—McKean Gas-Electric Cars.
12—Differential 20-yd. Cars.
5—Gasoline Passenger Cars
50—Freight Cars.
12—Electric Cars.

Get our List and Prices.

J. F. DONAHOO CO., Birmingham, Ala.

WORRYLESS ELECTRICAL REPAIRS

On all kinds and sizes A.C. or D.C. motors and generators, starters, welders, controllers, or anything electrical. Quick shipment from stock material of coils commutators—shafts—bearings, etc. Remember our initials stand for our product.

CAREFUL CLEVELAND ACCURATE ARMATURE WORRYLESS WORKS, Inc.

EST. 1898 4732-4-6 ST. CLAIR AVE., CLEVELAND INC. 1918

Electric Railway for Sale!

We have purchased the entire equipment of the Cincinnati & Columbus Traction Co., which was operated from Norwood to Hillsboro, O., a distance of approximately 53 miles, and offer for sale the following:

RAILS—

5000 tons No. 1, 70-lb. relaying steel rails.

WIRE—

500,000 lb. or more of copper trolley, feeder, high tension, etc.

POWER EQUIPMENT—

6 Babcock & Wilcox boilers, 165-lb. pressure, equipped with American stokers, forced and induced draft, and economizers.

Corliss Engines.

Generators.

Switchboards and Transformers.

Rotary Converters.

ROLLING STOCK (Standard Gauge)—

3 Passenger Cars, 40 tons, equipped with 4 G. E. 75-hp. motors.
2 Freight Cars, 40 tons, equipped with 4 G. E. 74-hp. motors.
4 Passenger Cars, 25 tons, equipped with 4 G. E. 57-hp. motors.
5 Box Cars, no motors.
3 Flat Cars, no motors.
1 Derrick Car, no motors.
5 Gondolas, no motors.
3 Gondola Cars, no motors, center dump.

Write or wire us, stating just what you are interested in, and we will be pleased to submit quotations and further particulars.

HYMAN-MICHAELS COMPANY

(Refer to Department J)

People's Gas Building, Chicago, Ill.

Branches: New York City—Pittsburgh—St. Louis

War Department

CORPS OF ENGINEERS

Offers for Sale by Informal Bid

STEEL RAIL and

Here are the Conditions of Sale

ALL material will be sold "as is," F.O.B. storage point. All material listed is unused. It is in open storage. Analysis of the steel cannot be given. It was originally inspected for the Government by R. W. Hunt & Co., and by the Pittsburgh Testing Laboratory. It may be inspected by authorized representative of the prospective bidder upon application to the officer in charge at points of storage. Quantities shown are approximate only.

Bids may be for the entire lot, or for the entire quantity at each separate storage point, or for the entire lot of each class of material, or for the listed quantity of each class of material at each separate storage point. *No special form of bid is required.* Bids may be made by letter or telegram.

In making bids for Rail, state price offered per gross ton; for Splice Bars, per pair; for Bolts and Nuts, Spikes, Tie-plates, per cwt.; for Rail Braces, Railroad Crossings, Re-railers, each. Delivery will begin within a short time after completion of contract. The Item Number as given in this advertisement must be specified for each item upon which bids are made.

All bids must be in *office, Chief of Engineers, Room 2706, Munitions Building, Washington, D. C., not later than 4:30 P. M., Eastern Time, March 29, 1920.* The right is reserved to reject any or all bids.

Successful bidders, immediately upon notification of award, will be required to furnish a certified check for 20% of the full amount due. Complete shipping instructions must be furnished within 30 days of notification of award. Further particulars and information may be obtained upon application to the *Office, Chief of Engineers, Room 2706, Munitions Building, Washington, D. C.*

Item E 101

67.53-POUND RUSSIAN RAIL—STANDARD LENGTHS

Approximately 1,333 gross tons.

Location:

520 gross tons at Norfolk, Va.
813 gross tons at Kearny, N. J.

For splice bars, track bolts and nuts for this rail, see Items E 107 and E 110.

Item E 102

35-POUND A. S. C. RAILS—15 FT. LENGTHS—UNDRILLED

Approximately 1,091 gross tons, no accessories. Made of "shell discard" steel.

Location:

57 gross tons at Norfolk, Va.
825 gross tons at Kearny, N. J.
90 gross tons at Port Newark, N. J.
119 gross tons at Philadelphia, Pa. (21st St. and Oregon Ave.)

Item E 103

30-POUND A. S. C. E. RAIL—26 FT. LENGTHS—DRILLED

Approximately 1,101 gross tons, no accessories.

Location:

Kearny, N. J.

Item E 104

25-POUND A. S. C. E. RAIL—UNDRILLED

Approximately 2,946 gross tons, lengths of 8, 10 and 12 ft. No accessories. Made of "shell discard" steel.

Location:

195 gross tons at Norfolk, Va.
2,571 gross tons at Kearny, N. J.
7 gross tons at Port Newark, N. J.
49 gross tons at New Cumberland, Pa. (near Harrisburg)
124 gross tons at Philadelphia, Pa. (21st St. and Oregon Ave.)

NOTE:—Items E-102 and E-104 were purchased for use as trench supports and for other military construction purposes.

War Department

CORPS OF ENGINEERS

Railroad & Construction Material

TRACK ACCESSORIES

Item E 105

RE-RAILERS
Total quantity, 3,200.
Location:
1,248 at Kearny, N. J.
1,925 at Schenectady, N. Y.

Item E 106

SPLICE BARS
(For 80 lb. A.R.A. Type "B" Rail)
Weight per pair about 48 lbs.
Total quantity, 86,900 pairs.
Location:
84,407 pairs at Norfolk, Va.
1,955 pairs at Port Newark, N. J.
538 pairs at Schenectady, N. Y.

Item E 107

SPLICE BARS
(For 67.53 lb. Russian Rail)
Weight per pair about 49 lbs.
Total quantity, 26,728 pairs.
Location:
Kearny, N. J.

Item E 108

SPLICE BARS
(For 50 lb. A.S.C.E. Rail)
Weight per pair about 26 lb.
Total quantity, 3,500 pairs.
Location:
Port Newark, N. J.

Item E 109

TRACK BOLTS AND NUTS ⅞ in. x 4¼ in.
(For 80 lb. A.R.A. Type "B" Rail)
Total quantity, 4,029 Kegs (200 lb. each)
Location:
3,182 Kegs at Norfolk, Va.
546 Kegs at Kearny, N. J.
301 Kegs at New Cumberland, Pa.

Item E 110

TRACK BOLTS AND NUTS
(For 67.53 lb Russian Rail)
Total quantity, 745 boxes (180 lb. each)
Location:
303 Boxes at 21st and Oregon Ave., Philadelphia, Pa.
442 Boxes at U. S. Arsenal, Pittsburgh, Pa.

Item E 111

TRACK SPIKES (½ in x 5 in.)
(For 40 lb. A.S.C.E. Rail)
Total quantity, 625 Kegs (200 lb. each)
Location:
Kearny, N. J.

Item E 112

TIE PLATES (6½ in. x 10 in.)
(For 80 lb. A.R.A. Type "B" Rail)
Total quantity, 75,560 pieces.
Location:
41,124 pieces at Norfolk, Va.
33,890 pieces at Kearny, N. J.
546 pieces at 21st and Oregon Ave., Philadelphia, Pa.

Item E 113

RAIL BRACES
(For 80 lb. A.R.A. Type "B" Rail)
Total quantity, 152,988.
Location:
86,208 Braces at Norfolk, Va.
27,320 Braces at Kearny, N. J.
39,460 Braces at Chicago, Ill.

Item E 114

RAILROAD CROSSINGS (4 ft. 8 11/16 in. GAUGE)
(80 lb. A.R.A. Type "B" Rail)
Angles of 45, 60, 75, and 90 degrees.
Total quantity, 32.
Location:
2-90 degree at Kearny, N. J.
10-75; 10-60; 10-45; deg. at Norfolk, Va.

Item E 115

RAILROAD CROSSINGS (4 ft. 8½ in. GAUGE)
(80 lb. A.R.A. Type "B" Rail)
Angles of 45, 60 and 75 degrees.
Total quantity, 48.
Location:
16-45 degree at Kearny, N. J.
20-75; 12-60 degrees at Norfolk, Va.

Item E 116

RAILROAD CROSSINGS (4 ft. 8 11/16 in. GAUGE)
(80 lb. A.R.A. Type "B" Rail)
Angles of 45, 60 and 90 degrees.
Total quantity, 20.
Location:
9-60; 3-45 degree at Kearny, N. J.
8-90 degree at Norfolk, Va.

Item E 117

RAILROAD CROSSINGS (4 ft. 8 11/16 in. GAUGE)
(67.53 lb. Russian Rail)
Angles of 30, 45, 60, 75, and 90 degrees.
Total quantity, 40.
Location:
Kearny, N. J.

The War Department, Corps of Engineers, is also offering for Sale **Locomotive Cranes** of leading makes. Information about these cranes may be obtained from Office of Chief of Engineers, Room 2706 Munitions Building, Washington, D. C.

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

Acetylene Service & Apparatus
Oxweld Acetylene Co.

Advertising, Street Car
Collier Inc Barron G.

Air Receivers
Ingersoll-Rand Co.

Air Aftercoolers
Ingersoll-Rand Co.

Air Rectifiers
Holden & White, Inc.

Ammeters
Weston Elec'l Instrument Co.

Anchors, Guy
Chance Co The
Electric Service Supplies Co.
Holden & White Inc
Johns-Manville Co., H. W.
Ohio Brass Co
Westinghouse Elec. & M. Co.

Ash Storage Tanks, Cast Iron
Green Engineering Company

Automobile and Buses
Brill Co., The J. G.

Axle Straighteners
Columbia M. W. & M. I. Co.

Axles, Car Wheel
Bemis Car Truck Co.
Brill Co. The J. G.
Standard Steel Works Co.
St Louis Car Co
Taylor Electric Truck Co
Westinghouse Elec. & M. Co.

Babbitt Metal
Ajax Metal Co
More-Jones B. & M. Co.

Babbitting Devices
Columbia M W & M I Co.

Badges and Buttons
Electric Service Supplies Co.
International Register Co. The

Bankers & Brokers
Coal & Iron National Bank

Batteries, Dry
Johns Manville Co H W

Batteries, Storage
Electric Storage Battery Co

Bearings and Bearing Metals
Ajax Metal Co
Bemis Car Truck Co
Columbia M W & M I Co.
Eureka Co
General Electric Co
More-Jones Brass & Metal Co.
St Louis Car Co
Taylor Electric Truck Co
Westinghouse Elec & M Co

Bearings, Center and Roller Side
Holden & White Inc
Stucki Co., A.

Bells and Gongs
Brill Co The J G
Columbia M. W & M I. Co.
Electric Service Supplies Co
St. Louis Car Co

Benders, Rail
Niles-Bement-Pond Co
Watson-Stillman Co
Zelnicker Walter A. Supply Co Inc

Ballers
Babcock & Wilcox Co.

Boiler Cleaning Compounds
Johns Manville Co H W

Boiler Coverings
Johns Manville Co H W

Boiler Tubes
National Tube Co

Bond Testers
American Steel & Wire Co.
Rail Welding & Bonding Co

Bonding Apparatus
American Steel & Wire Co.
Electric Railway Improvement Co.
Electric Service Supplies Co
Ohio Brass Co.
Oxweld Acetylene Co
Rail Welding & Bonding Co.

Bonds, Rail
American Steel & Wire Co.
Electric Railway Improvement Co
Electric Service Supplies Co
General Electric Co.
Johns Manville Co H W
Ohio Brass Co.
Rail Welding & Bonding Co
Westinghouse Elec & M Co

Boring Tools, Car Wheel
Niles Bement Pond Co

Brackets and Cross Arms, (See also Poles, Ties, Posts, Etc.)
American Bridge Co
Bates Expanded Steel Truss Co.
Creaghead Eng. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Hubbard & Co.
Lindsley Bros. Co.
Ohio Brass Co.

Brake Adjusters
Holden & White, Inc.
National Railway Appliance Co.
Westinghouse Traction Brake Co

Brake Shoes
Amer Brake Shoe & Fdry. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Taylor Electric Truck Co.
Wheel Truing Brake Shoe Co.

Brakes, Brake Systems and Brake Parts
Allis-Chalmers Mfg. Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Br Westinghouse Elec & Mfg. Co.
Columbia M. W. & M. I. Co.
General Electric Co.
Holden & White, Inc.
National Brake Co.
Safety Car Devices Co.
St. Louis Car Co
Taylor Electric Truck Co.
Westinghouse Traction Brake Co.

Bricks, Fire
Green Engineering Co.

Bridges & Buildings
American Bridge Co

Brooms, Track, Steel or Rattan
Zelnicker, Walter A Supply Co Inc.

Brushes, Carbon
General Electric Co.
Jeandron, W. J.
Morgan Crucible Co
United States Graphite Co.
Westinghouse Elec & M Co.

Brushes, Graphite
United States Graphite Co

Brush Holders
Anderson Mfg. Co., A & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.

Bunkers, Coal
American Bridge Co.

Bushings
Ives Co., The H. B.

Bushings, Case Hardened & Manganese
Bemis Car Truck Co.

Bushings, Graphite & Wooden
Bound Brook Oilless Bearing Co

Cables. (See Wires and Cables)

Calculating Machines
Monroe Calculating Machine Co.

Carbon Brushes. (See Brushes, Carbon)

Car Equipment. (For Fenders, Heaters, Registers, Wheels, etc. See those headings)

Car Trimmings. (For Curtains, Registers, Doors, Seats, etc. See those headings)

Car Panel Safety Switches
Westinghouse Elec & Mfg Co.

Cars, Dump
Differential Car Co

Cars, Passenger, Freight, Express, etc.
American Car Co
Brill Co., The J G
Kuhlman Car Co G C
McGuire-Cummings Mfg Co
National Railway Appliance Co
Thomas Perley A
Wilson Mfg Co

Cars, Second Hand
Electric Equipment Co

Car, Self-Propelled
Br Westinghouse Elec & Mfg Co
Electric Storage Battery Co
General Electric Co

Castings, Brass, Composition or Copper
Ajax Metal Co
Anderson Mfg Co A & J M
Columbia M W & M I Co
Eureka Co
More-Jones Brass & Metal Co

Castings, Gray Iron and Steel
American Bridge Co
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Standard Steel Works Co.
St. Louis Car Co.

Castings, Malleable and Brass
Amer. Brake Shoe & Fdry. Co.
Bemis Car Truck Co.
Columbia M. W & M. I Co.
St. Louis Car Co.

Catchers and Retrievers, Trolley
Electric Service Supplies Co.
Holden & White Inc.
Ohio Brass Co.
Wood Co., Chas. N

Ceiling, Car
Pantasote Co.

Circuit Breakers
Cutter Electrical & Mfg. Co., The
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps and Connectors for Wires and Cables
Anderson Mfg. Co., A. & J. M.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hubbard & Co.
Klein & Sons Matthias
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Cleaners and Scrapers Track—(See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G
Ohio Brass Co.

Clusters and Sockets
General Electric Co.

Coal and Ash Handling—(See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Columbia M W & M I Co
Electric Service Supplies Co.

Coils, Armature and Field
Cleveland Armature Works
Columbia M. W & M I Co.
D & W Fuse Co
General Electric Co
Independent Lamp & Wire Co.
King-Coil Mfg. Co.
Rome Wire Co.
Westinghouse Elec. & M. Co.

Coils, Choke and Kicking
Electric Service Supplies Co
General Electric Co
Westinghouse Elec. & M. Co.

Coin-Counting Machines
Electric Service Supplies Co
International Register Co., The
Johnson Fare Box Co

Comelong
Bush Electric Co.

Commutator Slotters
Electric Service Supplies Co.
General Electric Co
Westinghouse Elec & Mfg Co

Commutator Truing Devices
General Electric Co.

Commutators or Parts
Cameron Electrical Mfg. Co
Cleveland Armature Works
Columbia M. W. & M. I. Co
Eureka Co.
General Electric Co.
King Coil Mfg. Co
Westinghouse Elec & Mfg Co

Compressors, Air
Allis-Chalmers Mfg Co
Chicago Pneumatic Tool Co
General Electric Co
Ingersoll-Rand Co
Westinghouse Trac B Co

Compressors, Gas
Ingersoll Rand Co.

Condensers
Allis-Chalmers Mfg. Co
General Electric Co
Westinghouse Elec. & Mfg. Co.

Conduit Fittings
Chicago Fuse Mfg Co

Conduits, Underground
Johns Manville Co., H. W
Standard Underground Cable Co

Connectors, Solderless
Westinghouse Elec & Mfg Co

Controller Fingers
Eureka Co
Russell Mfg. Co

Controllers or Parts
Allis-Chalmers Mfg Co
Br Westinghouse Elec & Mfg Co
Columbia M. W. & M I Co.
Eureka Co
General Electric Co.
Johns-Manville Co., H. W.
Russell Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Controller Regulators
Electric Service Supplies Co.

Controlling Systems
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Converters, Rotary
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Conveyors, Belt
Portable Machinery Co.

Conveyors, Coal & Ash
Green Eng. Co.
Portable Machinery Co.

Conveyors, Portable
Portable Machinery Co.

Conveying and Hoisting Machinery
American Bridge Co.
Columbia M. W. & M. I. Co.
Green Engrg. Co.

Copper Wire
Anaconda Copper Mining Co.

Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Roebling Sons Co., John A.
Samson Cordage Works

Cord Connectors and Couplers
Electric Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.

Couplers, Car
Brill Co., The J. G.
Ohio Brass Co
Van Dorn Coupler Co.
Westinghouse Trac. B. Co.

Cranes
Allis-Chalmers Mfg. Co
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co The

Creosoting. (See Wood Preservatives)

Cross Arms. (See Brackets)

Crossing Foundations
International Steel Tie Co

Crossing Signals. (See Signals, Crossing)

Crushers, Rock
Allis-Chalmers Mfg. Co.

Crossings, Track. (See Track, Special Work)

Culverts
Canton Culvert & Silo Co

Curtains and Curtain Fixtures
Brill Co. The J. G
Electric Service Supplies Co.
Pantasote Co.

Cutouts
Chicago Fuse Mfg Co

Cutting Apparatus, Oxy-Acetylene
Oxweld Acetylene Co

Dealers' Machinery
Archer & Baldwin
Cleveland Armature Wks
Electric Equipment Co
Foster Co. L. B
Griswold Machine Co., Geo. M.
Hyman-Michaels Co
MacGovern & Co Inc
Zelnicker Supply Co., Inc., Walter A

Derailing Devices. (See also Track Work)
Cleveland Frog & Crossing Co.

Destination Signs
Columbia M. W. & M. I. Co.
Creaghead Eng. Co.
Electric Service Supplies Co

Detective Service
Wish Service P. Edward

Dogs, Lathe
Williams & Co J H

Door Operating Devices
Consolidated Car Heating Co
National Pneumatic Co Inc
Safety Car Devices Co

Doors, Asbestos
Johns-Manville Co H W

Doors and Door Fixtures
Brill Co The J G
General Electric Co
Hale & Kilburn Corp

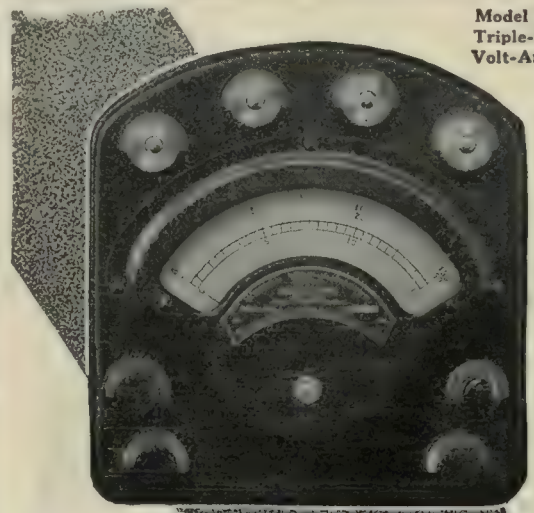


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Independent Lamp & Wire Co., Inc.

OFFICES: 1737 Broadway, New York
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WHAT AND WHERE TO BUY

Doors, Folding Vestibule
National Pneumatic Co., Inc.

Draft Rigging. (See Couplers)

Drills, Rock
Ingersoll-Rand Co.

Drills, Track
American Steel & Wire Co.
Chicago Pneumatic Tool Co.
Electric Service Supplies Co.
Niles-Bement-Pond Co
Ohio Brass Co.

Drinking Cups, Sanitary Paper
Individual Drinking Cup Co., Inc.

Drivers, Sand
Electric Service Supplies Co.
Zelnicker Supply Co., Walter A., Inc.

Electrical Wires and Cables
Roebling's Sons Co., J. A.

Engineers, Consulting, Contracting and Operating
Archbold-Brady Co.
Arnold Co., The
Clark Management Corp., E. W.
Drum & Co., A. L.
Feustel, Robert M.
Ford, Bacon & Davis
Holst, Englehardt W.
Jacobs & Co., J. L.
Republic Engineers, Inc.
Richey, Albert S.
Robinson & Co., Dwight P.
Sanderson & Porter
Sargent & Lundy
Scofield Engineering Co.
Stone & Webster
Wells, Gardner F.
White Companies, The J. G.
Woodmansee & Davidson Engineering Co.

Engines, Gas and Oil
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Engines, Steam
Allis-Chalmers Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Fare Boxes
Brill Co., The J. G.
Cleveland Fare Box Co.
Johnson Fare Box Co.
National Railway Appliance Co.
Ohmer Fare Register Co.

Fences, Woven Wire and Fence Posts
American Steel & Wire Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Cleveland Fare Box Co.
Consolidated Car Fender Co.
Electric Service Supplies Co.
Star Brass Works.

Fibre and Fibre Tubing
Johns-Manville Co., H. W.
Westinghouse Elec. & Mfg. Co.

Field Coils. (See Coils)

Filters, Water
Scaife & Sons Co., Wm. B.

Fire Extinguishing Apparatus
Castle Inc., James M.
Johns-Manville Co., H. W.

Fire Proofing Materials
Johns-Manville Co., H. W.

Floodlights
Electric Service Supplies Co.

Flooring Composition
American Mason Safety Tread Co.
Johns-Manville Co., H. W.

Flooring, Grating
Irving Iron Wks.

Forgings
Columbia Machine Wks. & M. Co.
Eureka Co.
Standard Steel Works Co.
Williams & Co., J. H.

Frogs, Track. (See Track Work)

Furnaces. (See Stokers)

Fuses and Fuse Boxes
Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
D. & W. Fuse Co.
General Electric Co.
Johns-Manville Co., H. W.
Westinghouse Elec. & Mfg. Co.
Williams & Co., J. H.

Fuses, Refillable
Columbia M. W. & M. I. Co.
General Electric Co.

Fuse Removers
Bush Electric Co.

Gages, Oil and Water
Ohio Brass Co.

Gaskets
Johns-Manville Co., H. W.
Power Specialty Co.
Westinghouse Traction Brake Co.

Gas-Electric Cars
General Electric Co.

Gas Producers
Westinghouse Elec. & Mfg. Co.

Gates, Car
Brill Co., The J. G.

Gear Blanks
Standard Steel Works Co.

Gear Cases
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Westinghouse Elec. & Mfg. Co.

Gears and Pinions
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
National Railway Appliance Co.
Nuttall Co., R. D.
Tool Steel Gear & Pinion Co.

Generating Sets, Gas-Electric
General Electric Co.

Generators
Allis-Chalmers Mfg. Co.
English Electric Co., Ltd.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Gongs. (See Bells and Gongs)

Graphite
Morgan Crucible Co.

Grates, Chain
Green Eng. Co.

Greases. (See Lubricants)

Grinders and Grinding Supplies
Metal & Thermit Corp.
Railway Track-work Co.

Grinding Blocks and Wheels
Railway Track-work Co.

Guards, Cattle
American Bridge Co.

Guards, Trolley
Electric Service Supplies Co.
Ohio Brass Co.

Harps, Trolley
Anderson M. Co., A. & J. M.
Bayonet Trolley Harp Co.
Electric Service Supplies Co.
Hemsley Trolley & Mfg. Co.
More-Jones B. & M. Co.
Nuttall Co., R. D.
Star Brass Works

Headlights
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
St. Louis Car Co.

Headlining
Pantasote Co.

Heaters, Car (Electric)
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
Holden & White, Inc.
National Railway Appliance Co.
Smith Heater Co., Peter

Heaters, Car, Hot Air and Water
Cooper Heater Co.
Holden & White, Inc.
Smith Heater Co., Peter

Heaters, Car (Stove)
Electric Service Supplies Co.
Holden & White, Inc.
Smith Heater Co., Peter

Hoists and Lifts
Columbia M. W. & M. I. Co.
Ford-Chain Block Co.
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The
Yale & Towne Mfg. Co.

Hose
Ingersoll-Rand Co.

Hose, Bridges
Ohio Brass Co.

Hose, Pneumatic & Fire
Johns-Manville Co., H. W.

Hydraulic Machinery
Allis-Chalmers Mfg. Co.
Niles-Bement-Pond Co.
Watson-Stillman Co.

Inspection
Electrical Testing Lab's

Instruments, Measuring, Testing and Recording
Economy Electric Devices Co.
General Electric Co.
Johns-Manville Co., H. W.
Westinghouse Elec. & Mfg. Co.
Weston Elec'l Instrument Co.

Insulating Cloth, Paper and Tape
Anchor Webbing Co.
General Electric Co.
Hope Webbing Co.
Johns-Manville Co., H. W.
Okonite Co., The
Standard Underground Cable Co.
U. S. Rubber Co.
Westinghouse Elec. & Mfg. Co.

Insulating Machinery
American Insulating Machinery Co.

Insulation. (See also Paints)
Anderson M. Co., A. & J. M.
Drew Electric & Mfg. Co.
Electric Ry. Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Holden & White, Inc.
Johns-Manville Co., H. W.
Mitchell-Rand Mfg. Co.
Okonite Co., The
U. S. Rubber Co.
Westinghouse Elec. & Mfg. Co.

Insulators. (See also Line Material)
Anderson M. Co., A. & J. M.
Creaghead Engineering Co.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Johns-Manville Co., H. W.
Macallen Co., The
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Insulator Pins
Electric Service Supplies Co.
Hubbard & Co.

Inventions Developed & Perfected
Peters & Co., G. D.

Jacks. (See also Cranes, Hoists and Lifts)
Brill Co., The J. G.
Buckeye Jack Mfg. Co.
Columbia M. W. & M. I. Co.
National Ry. Appliance Co.
Templeton, Kenly Co., Ltd.
Watson-Stillman Co.

Joints, Rail
Zelnicker Supply Company, Inc., Walter A.

Journal Boxes
Bemis Car Truck Co.
Brill Co., J. G.

Junction Boxes
Johns-Manville Co., H. W.
Standard Underground Cable Co.

Laboratories
Electric Testing Lab's

Lamp Guards and Fixtures
Anderson M. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Arc and Incandescent. (See also Headlights)
Anderson M. Co., A. & J. M.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Signal and Marker
Ohio Brass Co.

Lathe Attachments
Williams & Co., J. H.

Lathes, Car Wheel
Niles-Bement-Pond Co.

Lighting Regulators, Car
Holden & White, Inc.

Lightning Protection
Anderson M. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Line Material. (See also Brackets, Insulators, Wires, etc.)
Anderson M. Co., A. & J. M.
Archbold Brady Co.
Chance Co., The
Columbia M. W. & M. I. Co.
Creaghead Eng. Co.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
English Electric Co., Ltd.
Eureka Co.
General Electric Co.
Holden & White, Inc.
Hubbard & Co.
Johns-Manville Co., H. W.
Macallen Co., The
More-Jones B. & M. Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Loaders, Wagon, Truck or Car
Portable Machinery Co.

Locomotives, Electric
Brill Co., The J. G.
General Electric Co.
McGuire-Cummings Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Lubricating Engineers
Galena-Signal Oil Co.
Texas Co., The
Universal Lubricating Co.

Lumber. (See Poles, Ties, etc.)

Lubricants, Oil and Grease
Berne Sarvmeer Co.
Galena-Signal Oil Co.
Texas Co., The
Universal Lubricating Co.

Machine Tools
Columbia M. W. & M. I. Co.
Niles-Bement-Pond Co.
Watson-Stillman Co.

Machine Work
Columbia M. W. & M. I. Co.
Holden & White, Inc.

Mats
Johns-Manville Co., H. W.

Meters, Car, Watt-Hour
Economy Electric Devices Co.

Meters. (See Instruments)
Electric Service Supplies Co.

Mica
Cronkhite Co., Inc., The
Macallen Co., The

Mirrors for Motormen
Drew Elec. & Mfg. Co.

Motormen's Seats
Electric Service Supplies Co.
Wood Co., Chas. N.

Motors, Electric
Allis-Chalmers Mfg. Co.
Br. Westinghouse Elec. & Mfg. Co.
English Electric Co., Ltd.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Motor and Generator Sets
General Electric Co.

Nuts and Bolts
Allis-Chalmers Mfg. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Hubbard & Co.

Ohmmeters
Weston Elec'l Instrument Co.

Oils. (See Lubricants)

Oxy-Acetylene. (See Cutting Apparatus, Oxy-Acetylene)

Packing
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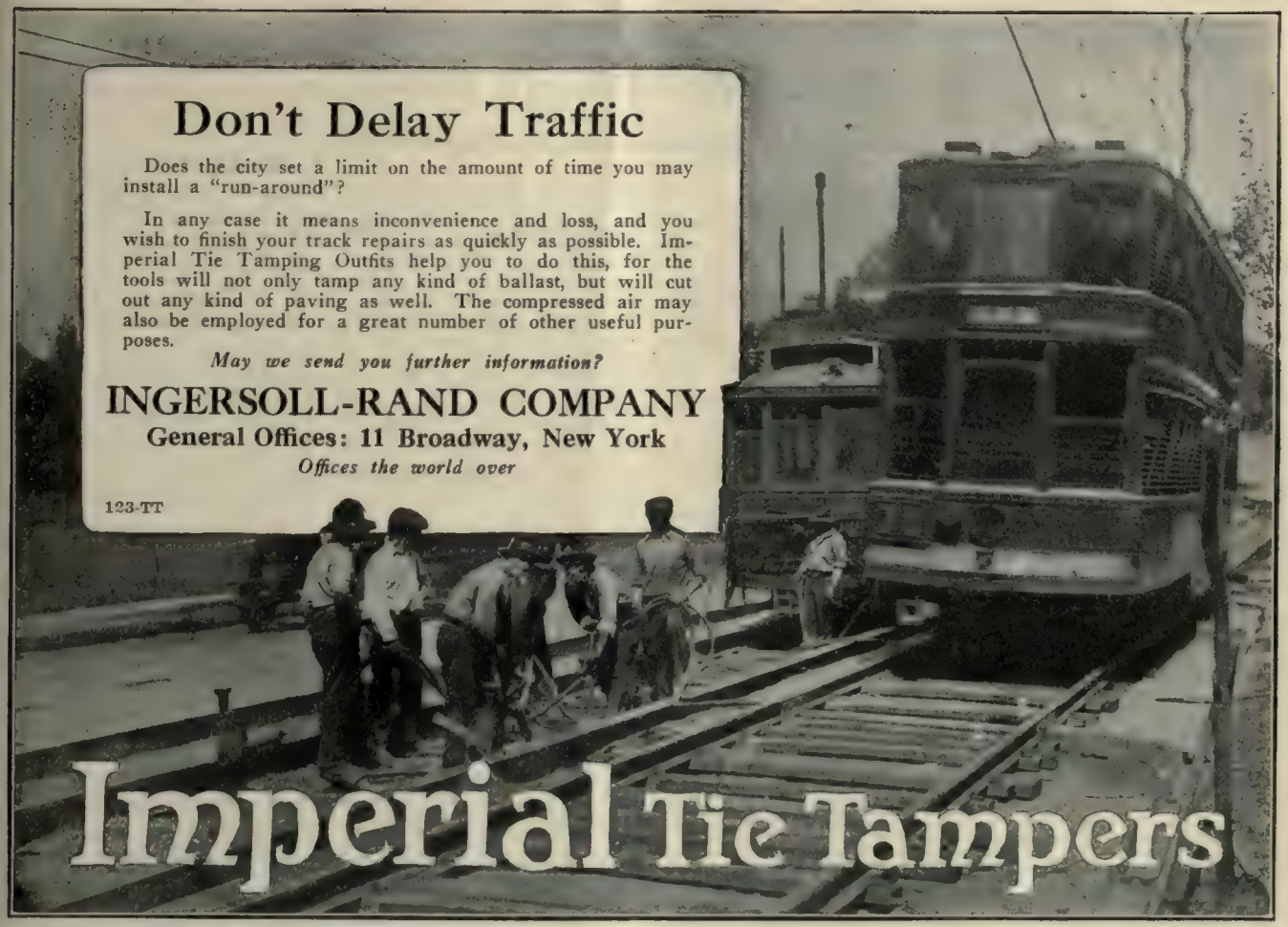
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Our products used on all leading railroads on cars and stations. For details address
AMERICAN MASON SAFETY TREAD CO., Lowell, Mass.
Branch Offices: Boston, New York City, Philadelphia
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UNIVERSAL ANTI-SLIP TREADS

cars and station steps.

Universal Safety Tread Company

40 Court St., Boston, Mass.



The Trouble Chasers

NEVER *looking* for trouble but very much on the job whenever, *wherever* needed!

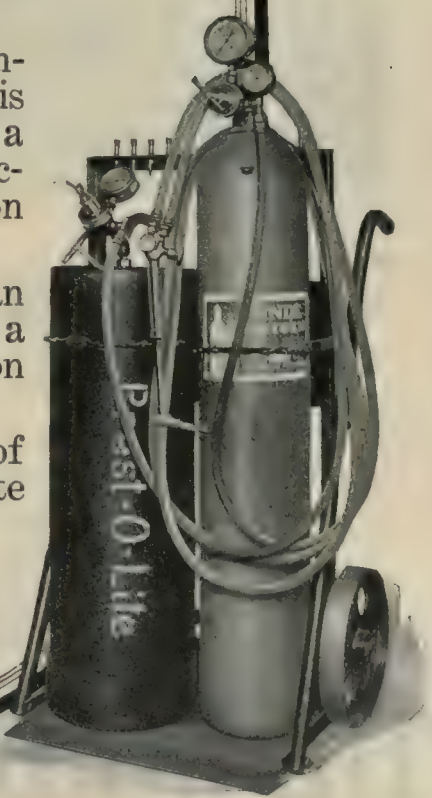
Oxweld is the trouble chaser of industry.

There are Oxweld Sales Service Centers in more than 50 large cities. This great organization opens up to you a treasure house of oxwelding production data, ready for instant application to *your* problem in *your* plant.

A request from you will bring an Oxweld Engineer to your door in a hurry—ready to tackle your production problem and to solve it.

Write, wire or telephone to any of the addresses below for immediate attention from the nearest Service Center.

O509



OXWELD ACETYLENE COMPANY

Newark, N. J. **Chicago** **Los Angeles**

World's Largest Maker of Equipment for Oxwelding and Cutting Metals

When Time Means Most



The Peter Witt Car:

With its extra-wide entrance and exit door openings and with the conductor located on forward side of the center door, facilitates quick loading and unloading of passengers and with the collection of fares on the "pay-as-you-pass" system eliminates delays during heavy traffic periods, when time means most.

THE J. G. BRILL COMPANY

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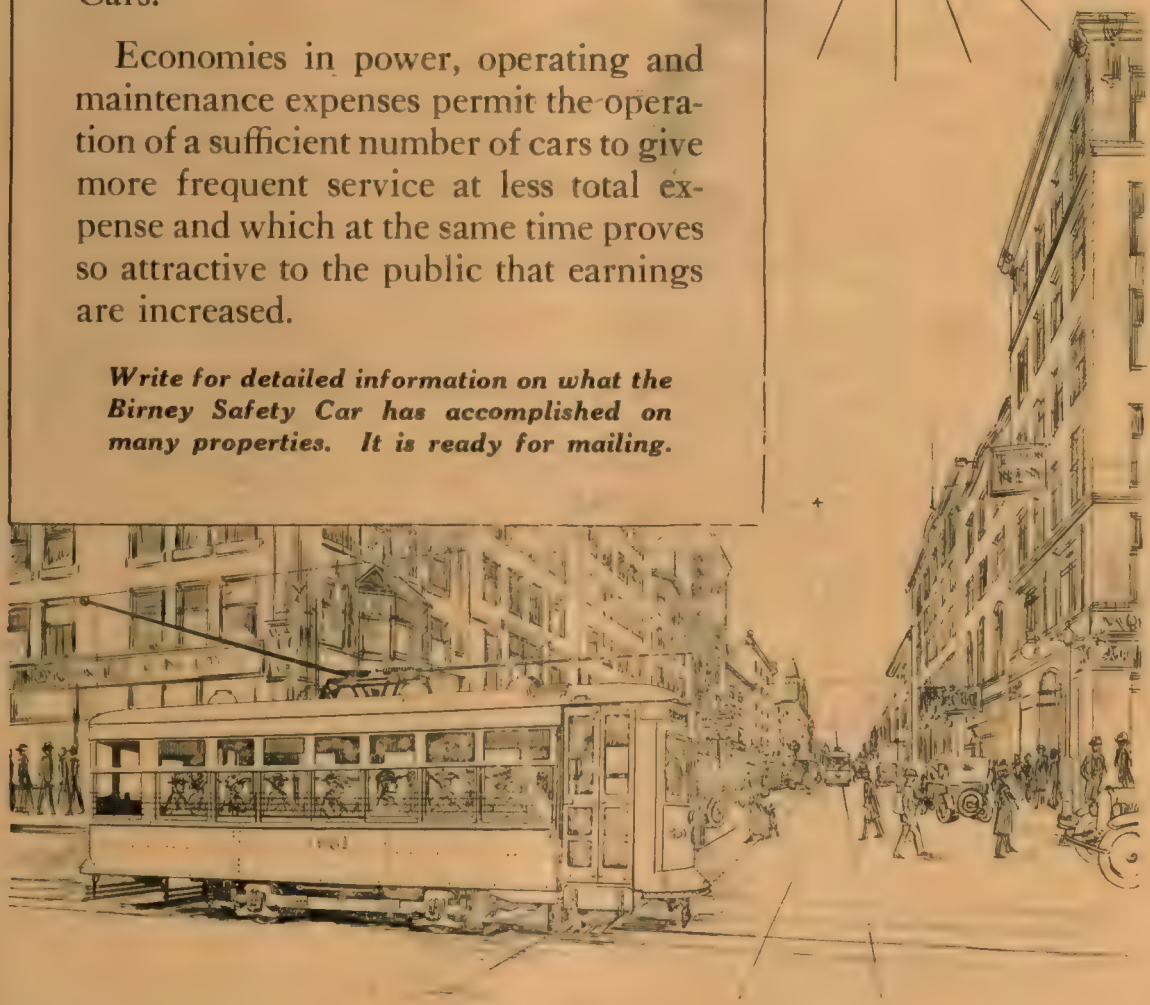
Adequate Service

A car service adequately meeting the demand of the general public for transportation is possible with Birney Safety Cars.

Economies in power, operating and maintenance expenses permit the operation of a sufficient number of cars to give more frequent service at less total expense and which at the same time proves so attractive to the public that earnings are increased.

Write for detailed information on what the Birney Safety Car has accomplished on many properties. It is ready for mailing.

BIRNEY SAFETY CAR



THE J. G. BRILL COMPANY

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AMERICAN CAR CO., St. Louis, Mo.
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K-24

The Standard Controller for Safety Cars

When considering the purchase of light-weight, compact, really efficient controllers, a process of elimination generally takes place, and it always sifts down to the "old reliable" K-63.

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Controller
Assembly Department

26-63

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ELECTRIC RAILWAY JOURNAL

HOUSTON LYCEUM

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Portable Rail Bonding Apparatus

That's the record made with the Erico on the Cleveland, Southwestern and Columbus Railway.

One rail bonded with our standard E-T 5¼-in. 4/0 bond at every joint with an occasional replacement on the other rail. Only three men on the job—one to operate the grinder, take up crossing planks, etc.—two to do the actual bonding.

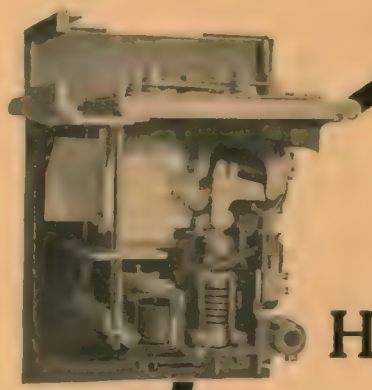
And 156 bonds per day of 8½ hours. A remarkable record, surely, but not an unusual one with the Erico.

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Cleveland, Ohio, U. S. A.



First-Class High-Speed Service

Provided by the Very Best Interurban Equipment





No. 557 Motors and HLF Control

The satisfaction rendered by the first fifteen equipments purchased in 1915 by the Chicago, North Shore & Milwaukee Electric Railroad for high-speed passenger service, resulted in repeat orders, making a total of 45 equipments for passenger cars and 12 for freight cars.

W
WESTINGHOUSE ELECTRIC

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.



Westinghouse

Vol. 55, No. 11 New York, March 13, 1920 *Pages 503 to 550*

Electric Railway Journal

H. W. BLAKE, *Editor*

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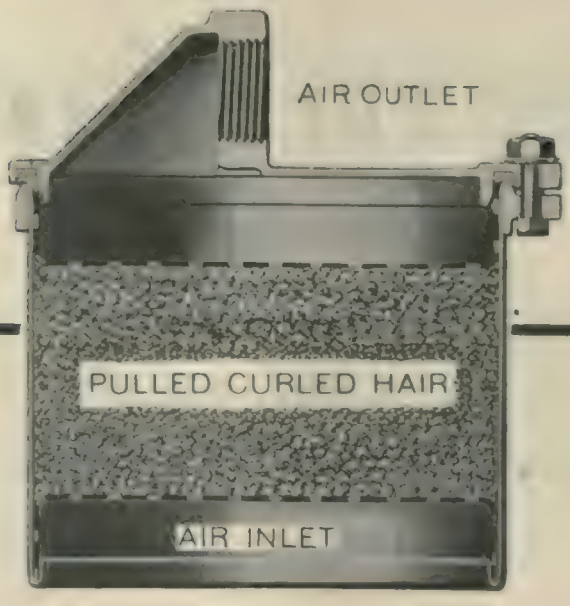
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Circulation of this issue, 7,000 copies

Advertising Indexes—Alphabetical, 64; Classified, 58, 60, 62; Searchlight Section, 53-57



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Excluding dirt from the Air Compressor makes Perfect Lubrication Possible.

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The use of these materials insures continuity of service and therefore lower maintenance costs.

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JACKSON FINDS

There's Wisdom in the Use of Safety Cars

Early in June, 1919, the Jackson Railway & Light Company, Jackson, Tenn., began *genuine* Safety Car operation. Hardly a month had elapsed before we received the following letter from the delighted user:

JACKSON RAILWAY & LIGHT COMPANY

Jackson, Tenn., July 25, 1919.

Mr. C. P. Cass, President,
Safety Car Devices Company,
Boatmen's Bank Building, St. Louis, Mo.

My Dear Mr. Cass:

So far our new Safety Cars have been very satisfactory indeed. They are *very popular with the public and our men,* and we have had no objection from the city officials.

We have been able to *speed up our schedules,* and there is no doubt of the fact that the cars have *increased earnings.*

Very truly yours,
(Signed) JOHN WISDOM, *General Superintendent.*

Note the portions of Mr. Wisdom's letter that we have taken the liberty of italicizing. It's wonderful how all the fancied objections to Safety Car operation vanish into thin air when operation actually begins. And at Jackson, Tenn., it is the car operators themselves who are most pleased because they had never used air brakes before. But the use of air brakes is only one feature of the making of a Safety Car. It is not a 100 per cent Safety Car unless it is equipped with automatic, laborless apparatus, so interlocked that, regardless of the illness, or distraction of the operator, the power will be cut off instantaneously, the air brakes and sander applied immediately thereafter, and the doors unlatched for safe and easy exit. *Furthermore,* it is a Safety Car only when the doors must be closed and the step folded before the car can start, and when the air brake must be applied before the doors are opened and the step lowered in bringing the car to a service stop.

SAFETY CAR DEVICES COMPANY

***Main Office*—Boatmen's Bank Building, ST. LOUIS**

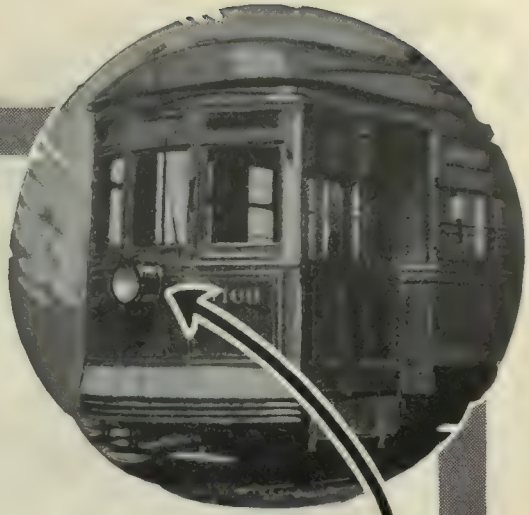
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Whether your cars operate on bright streets, through dim suburbs or on private right of way, there are Crouse-Hinds Imperial Headlights for them.

You can pick a type with just the right quantity and quality of illumination, and be sure that it will serve steadily, dependably.

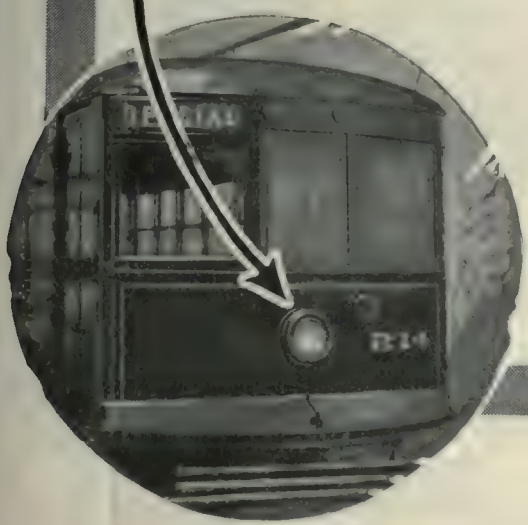
There are numerous types of Incandescents, Luminous Arcs and Carbon Arcs in the complete Crouse-Hinds Imperial Line.

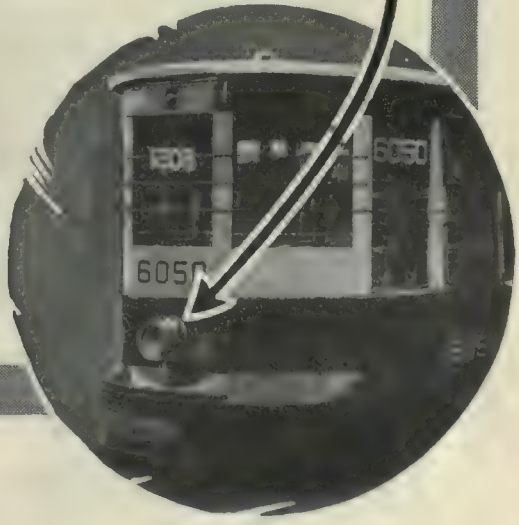
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The ability of Phono-Electric contact wire to collect energy at high voltage without pitting, burning, fusing and corroding, as evidenced by years of experience on this road, are among the

Many Sound Reasons for Its Use

Bridgeport Brass Company
Bridgeport Connecticut

INTERNATIONAL STEEL TWIN TIES on Bridge Floors

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Immediate shipments can be made on Twin Ties for Bridge Floors



The International Steel Tie Company

Manufacturers of Steel Twin Ties and Crossing Foundations

General Sales Office and Works: Cleveland, Ohio

"from mine to finished Product"

ANACONDA

COPPER WIRE

Containing less than 1/100 of 1% metallic impurities

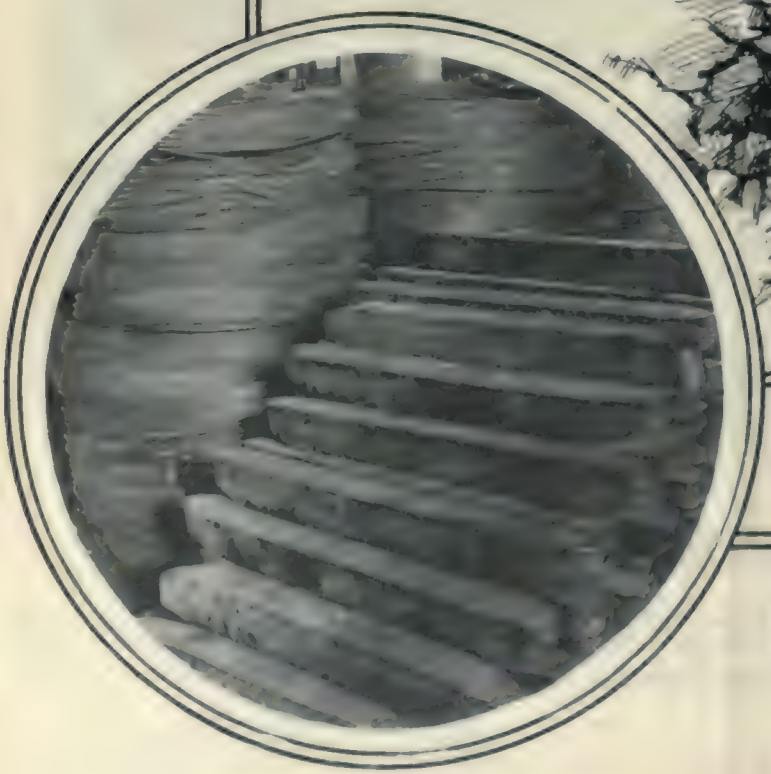
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Oxygen	.02%	— .05%
Silver	.0010%	
Gold	.00001%	
Sulphur	.0030%	
Iron	.0025%	
Nickel	.0015%	
Arsenic	.0015%	
Antimony	.0020%	

The above is a representative analysis of the famous B & M Brand Copper from which all Anaconda Copper Wire is made. It is upon this analysis that we base and substantiate our claim of exceptional purity.

Anaconda Copper Wire is made in a great variety of sizes and in every degree of hardness. Allow our engineers to figure on your requirements.

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General Office
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Allow our Engineers to figure on your requirements

Anaconda Copper Wire and Electrolytic Copper Bars

Genuine "Shelby"
(Seamless Cold Drawn Steel)

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In the design of the Shelby trolley poles, minimum weight combined with ample strength is secured by the use of a reinforcement on the inside and at the base. This reinforcing member being made integral with the pole and of the same 13 gauge selected grade open hearth steel.

The Shelby pole is made in two designs—Standard A, for all ordinary service and the lightest pole it is practicable to manufacture or use—Standard B, with long reinforcing, intended to meet the most severe service conditions.

Special designs made to meet special requirements.

A new booklet just off the press gives specifications in detail and describes the method of testing these poles before they leave the mill.



ELECTRIC SERVICE SUPPLIES CO.

Manufacturers of Railway Material and Electrical Supplies

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17th and Cambria Streets

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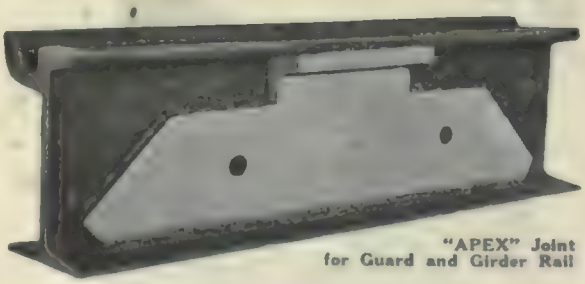
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MARCH 13—*Lucky Day!*

Every day is Lucky Day for the Electric Railway using "Indianapolis" track reclamation products





"APEX" Joint for Guard and Girder Rail

Indianapolis Welders — now in their ninth year—indispensable for track and equipment maintenance.

Indianapolis Welded Joints and *Bonds*—cost less—save more, than any other type.

Indianapolis Fluxated Welding Steel—makes permanent welds.

Indianapolis Composite Eye Lenses — absolutely protect the operator.

Special Announcement!

The sale of Indianapolis joint and bonding plates for first two months of 1920 exceeds first six months of any other year.

Indianapolis Switch & Frog Co.

Springfield, Ohio



"Little Giant" Speed Makes Screw Spikes Economically Practical

LITTLE GIANT Electric Spike Drivers, by virtue of their speed and economy, have made possible the adoption of the screw spike—now widely recognized as far superior to the old nail spike. Screw spikes hold the tie right and do away entirely with that shattering of the fibres of the tie, which invites decay, and which invariably occurs during the sledging in of the nail spike. Today many railways are using the screw spike—and "Little Giants" for driving them. Watch a "Little Giant" on the job. The spike is set; over the head the operator places the "Little Giant;" the turn of a switch and the powerful rotary tool is screwing down the spike. When the pressure of the spike head against the rail has reached a predetermined amount—off goes the circuit breaker—and the drill stops. This means uniform holding tension at every spike.

The Little Giant Electric Spike Driver is but one of a line of electric tools for railway shop and track work, of which Little Giant Drills, Track Drills and Grinders, and Boyer Pneumatic Hammers are important members. Write for Bulletins.

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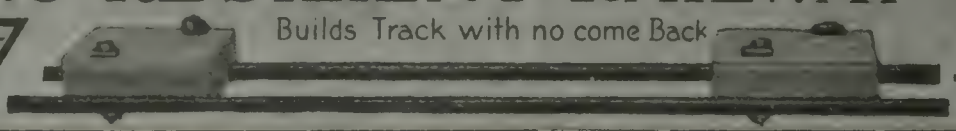
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LITTLE *Electric* GIANT *Tools*

CHICAGO PNEUMATIC

The RESILIENT RAILWAY TIE

Builds Track with no come Back



Why does pavement last longer when the principle of

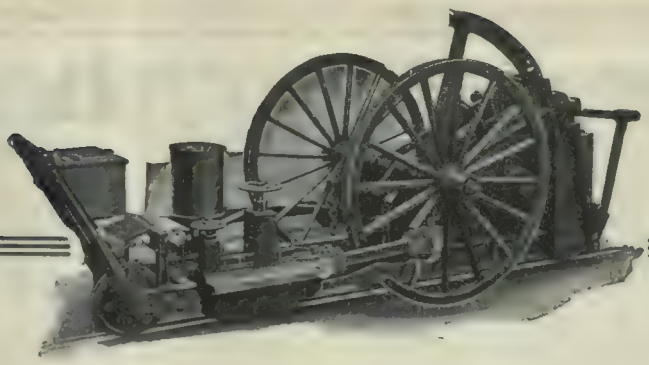
Resiliency

is applied to the car tracks?

The Asphalt cushion of the Resilient Railway Tie gives an unvarying deflection to the rail under the weight of the cars. Not too much as in the case of wood ties working in ballast nor too little as in monolithic construction. The joint ties prevent all working at the joints.

These things accomplished by Resilient Ties make toward pavement permanence.

THE DAYTON MECHANICAL TIE CO., 704 COMMERCIAL BLDG., DAYTON, OHIO



Where Unskilled Labor Works as Well as Skilled Labor

It seems to be the feeling of some Electric Railways that in order to get successful Track grinding results a skilled mechanic is necessary for the operation of the Track Grinder.

This is not so. The Reciprocating Track Grinder is so simple that after a few days' instructions any man on your track force can operate it with the greatest amount of success.

For those who still are pessimistic about the need of and the ease with which it can be used we offer to put a Reciprocating Track Grinder at work on your own tracks. This trial if you are not satisfied will cost you nothing. To make the test we will use your own men. This offer should interest you and we await your commands.

Largest manufacturer of both Reciprocating and Rotary Track Grinders in the World.

Railway Track-work Co.

3132 East Thompson St., Philadelphia

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ATLAS RAILWAY SUPPLY CO.
Chicago, Ill.

ELECTRICAL ENGINEERING & MANUFACTURING CO.
Pittsburgh, Pa.

EXCLUSIVE AGENTS
New England
CHARLES N. WOOD CO.
Boston, Mass.

HITCHCOCK, LLOYD & CO., Inc.
77A Queen Victoria Street, E. C.
London, England

ABBOTT RAIL-JOINT PLATES

Solve the most difficult feature of the rail-spreading problem



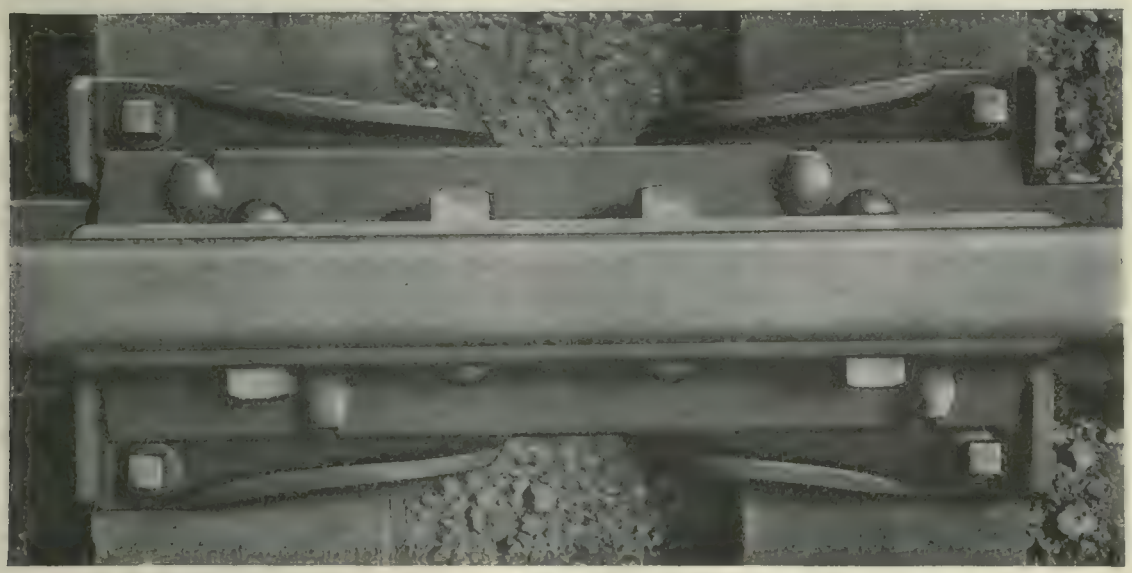
Holding rails to correct gage is largely a matter of holding *rail joints* to gage. This is proven on curves, where spreading of rail is most apt to occur. It is always the experience here that the spreading tendency is strongest *at the joints.*

Where the Abbott Rail-Joint Plate is used no spreading can occur at the joint without carrying the plate along with the rail, because the rail fits closely between the upturned plate ends.

That the plate is a very secure arrangement for holding the joint and rail to gage and is the best preventive measure against spreading must be evident from a glance of the illustrations. Not only are the spikes driven on the outside of the rail effective in retaining the gage, but those driven on the inside of the rail are equally effective. Further, the four plate holding spikes, not in contact with the rail at all, are equally serviceable for this purpose and act with full effect in maintaining the gage. The protection against spreading as effected by the eight spikes in the joint is



An example of the good track surface that can be maintained by using Abbott Rail Joint Plates. There is no batter or dip at the rail ends on this track. The smooth running surface and absence of deflection of these well supported joints avoids all pounding. This road uses a 70-lb. rail and has over 1300 Abbott Plates protecting the joints.



An installation of the Abbott Rail-Joint Plate showing how all rail and all plate holding spikes and the upturned plate ends hold the rail firmly against spreading.

therefore just about four times as great as secured with the two outside spikes if only the ordinary joint and splice bars were used.

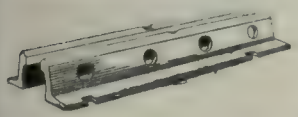
Quite naturally this distribution of the spreading stress onto eight instead of two spikes eliminates any slanting over of the spikes toward the outside, reduces neck wear on the spikes, maintains the tight hold of each spike in the ties and keeps the ties sound and useful for a much longer period.

Aside from all the other advantages, the prevention of spreading is in itself sufficient justification for the installation of Abbott Plates on all heavily loaded track and on at least the curves of the less used track.

Ask for our booklet "Lackawanna Improved Track Appliances," and if you want it, the free advice of our Engineers

Other Lackawanna Aids to Better Track

The Lackawanna Safety-Head Angle Bar



overcomes liability to wear and fracture by preventing cutting of the bar at the top from back action or upward thrust of the rail ends. This is accomplished by a slight depression in the head of the angle bar for a short space at the center where the rail ends meet.

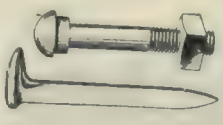
The Lackawanna Hook-Shoulder Tie Plate



is simple, strong, durable, convenient for installation, and by holding the rail with great security prevents undue wear and destruction of material; saves repair costs and reduces maintenance labor.
Two ribs on top form a channel in which the rail base rests. One of the ribs is plain and the other hooked to make a holder. One or two plain spikes on the plain rib complete the bond between plate and both rail flanges. The plate is fastened to the tie by independent plain or screw spikes. The rail may be removed without disturbing the plate.

The Lackawanna Deseaming Process

to which all our rails are subjected, leaves the rail head and base free from the cracks and weak, streaky, laminated, partially decarburized metal that under ordinary manufacturing processes is an inherent cause of undue surface wear and rail fracture.



Lackawanna Track Bolts and Spikes

Our track bolts and spikes of all standard sizes for light or heavy rails, enjoy an enviable reputation for careful, accurate workmanship and finish.

Write for our booklets, "Lackawanna Deseamed Rails," "Lackawanna Improved Track Appliances," and "Lackawanna Track Bolts and Spikes."

Lackawanna Steel Company

General Sales Office and Works: Lackawanna, N. Y.

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Sole Exporter of Our Commercial Products: Consolidated Steel Corporation, 165 Broadway, New York.

456



THERMIT-WELDED Special Work
Has Made Quick and Economical Home Assembly Possible

Instead of spending many thousands of dollars for special tools to make and machine special-alloy frogs and crossings, or of spending weary weeks waiting for installations, you can now build up at home, through the application of Thermit Welding, almost any kind of intersection that you need.

The tedious and costly processes of drilling bolt-holes, of shaping joint plates, of fitting and re-fitting are no longer necessary.

At your own leisure in your own shops you weld as large a part of each intersection as can be conveniently transported; then deposit the fractions in place, weld them to one another and the through track and Presto! the job is done without holding up traffic night after night.

And all this is achieved at an enormous reduction from the present cost of special work. Thermit-Welded special work is far more durable than ordinary built-up work and it has even proved its superiority to costly manganese hard-center inserts.

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THERMIT-WELDED Special Work is Not Just for Repair—It's for Permanence

Just advise us what rail sections you use and how many crossings of each you wish to make, and we will quote you prices at once. The permanent Thermit equipment, costing less than $150, can also be used for welding compromise joints, broken motor cases, truck frames, armature shafts or any other heavy steel sections.

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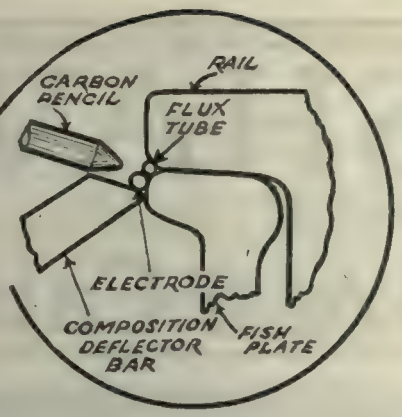
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March 20

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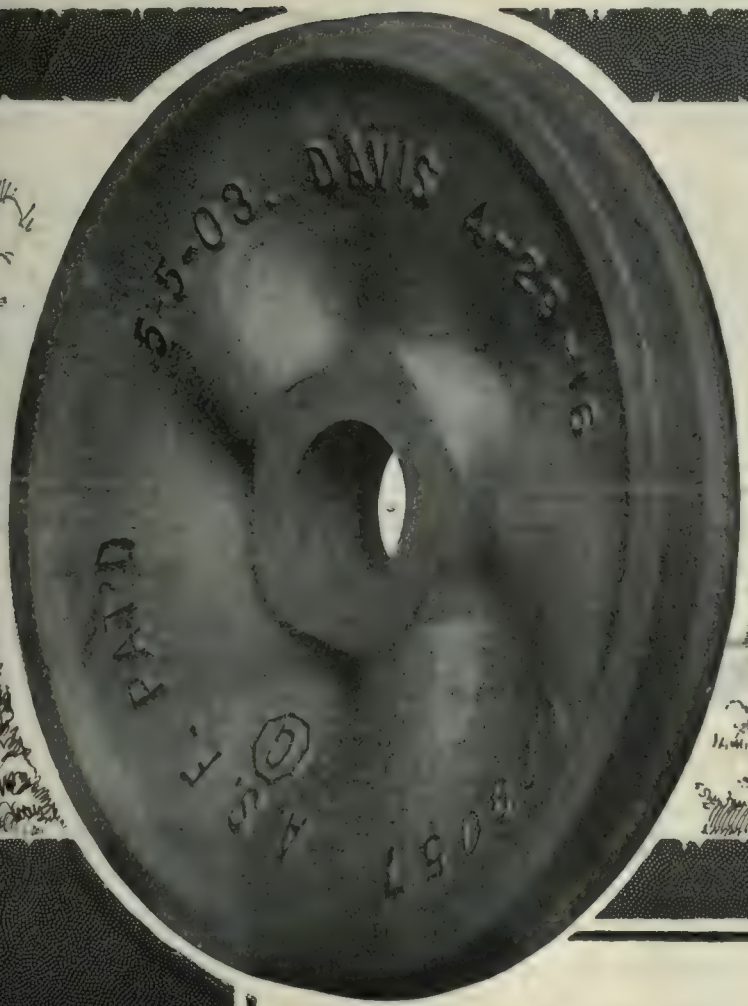
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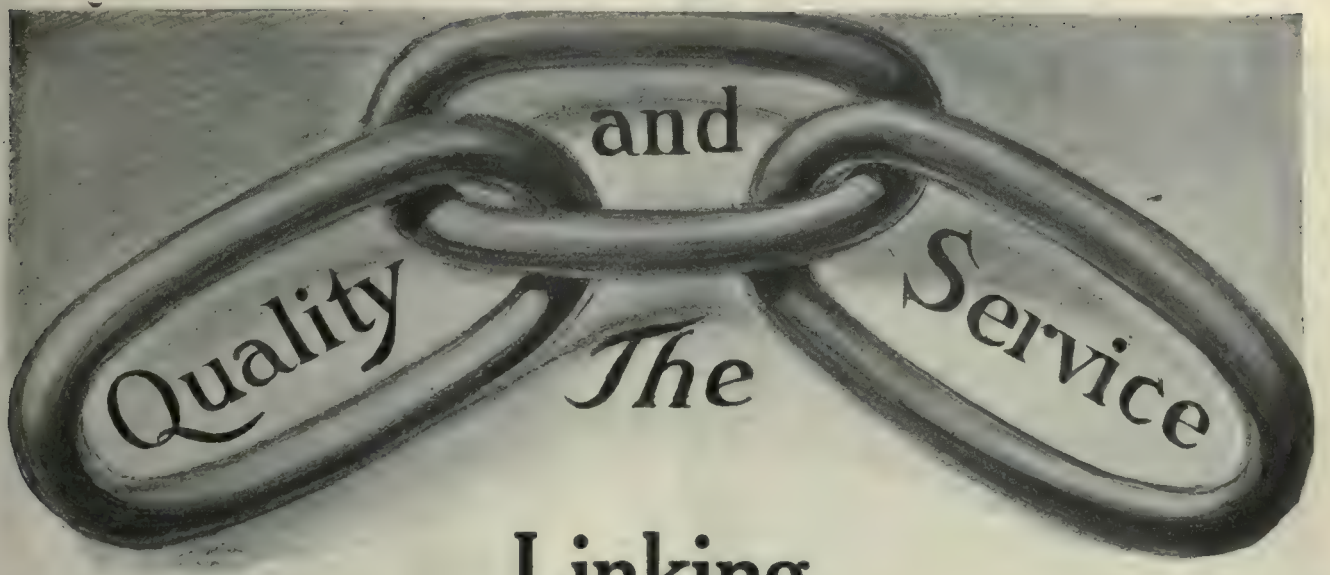
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Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Volume 55 New York, Saturday, March 13, 1920 *Number* 11

The Electric Railway a "Regular Gold Mine"

ELECTRIC railways have often been likened to gold mines in the popular version, but the defenders of the industry have not appreciated how truthful the analogy was in some respects. One of these is that they have been required by statute to sell their product at a uniform price, for the electric railway at 5 cents per ride, and for the gold mine, $20.67 an ounce. Both the electric railway corporation and the gold mining corporation are faced with greatly increased operating costs, they have not been able to change the price of their product to conform with changes in cost of production.

It has been hard to find another industry suffering from the same malady as the electric railway industry which has usually been pointed out as the lone sufferer. But now we learn from a statement made to Congress by Harold N. Lawrie, economist for the American Mining Congress, that gold mines are being closed down at an alarming rate because of the fixed price of that which they sell and the greatly inflated price of that which they buy—labor, tools, materials, etc. The gold producer finds the actual purchasing power of an ounce of gold is now $9 instead of $20.67. The result of this condition is shown by the figures covering gold production in the United States. It has fallen from $101,000,000 in 1915 to $58,500,000 in 1919, a loss of 42 per cent.

Having found a *camarade en misère*, perhaps the electric railway industry may find some consolation in the fact that, at least, to get an increase in the selling price of its commodity, it does not have to upset the whole monetary system of the nation and possibly cause international complications.

Don't Kill the Safety Car Goose!

JUDGING from a recent occurrence, the Reuben who killed the goose that laid one golden egg per diem in order to get the whole El Dorado at once left some progeny that blundered into the electric railway field! At any rate, this is what happened.

The company had put on a number of cars equipped with safety appliances. Imagine the general manager's astonishment, therefore, when the claims department told him that several severe accidents had occurred in connection with these cars. Incredulous, he asked for a detailed statement of accidents car per car. No sooner had this list been examined than it developed that the very cars that had been responsible for the worst cases were not equipped with the requisite safety appliances at all. It also proved that the transportation superintendent was so carried away by the platform savings of the safety cars that he had sent out quite a number of the regular style of car at irregular intervals with but one man each. Of course, this was a most unwise proceeding, for not only did the accidents obliterate the platform savings, but they also gave a black eye to the cars which had been properly converted.

Another similar practice which is not to be commended is that of regularly mixing in service new safety cars and old one-man cars without any safety appliances whatever. Even if the company is lucky enough to escape accidents, it cannot escape deserved criticism. In one instance, this policy has afforded an unreasonable labor element to agitate against any and every class of car having a single operator. Thus, exceeding haste to achieve the economies which electric railways so sorely need is in danger of defeating its purpose. With the right way, the popular way and the successful way made so clear by the experience of scores and scores of electric railways, there is no worth while excuse for policies of the kinds criticized.

The Railway Power Substation Is Developing Rapidly

PARTLY by coincidence and partly by intention this issue of the Electric Railway Journal contains an unusual aggregation of articles on substations. Two important associations, the A.I.E.E. and the C.E.R.A., met during the past few days and spent much of their time discussing this topic. The fact simply illustrates the prominence of the substation in the minds of railway people today. No subject of recent years involves more interesting and important technical questions, and the substation plays an important part also in operating economy.

Consider for a moment how vital the substation is to economical distribution. In the good old days of direct current power generation the area over which current could be distributed was limited and the required amount of feeder copper was frightful. Alternating current distribution simply had to be developed, for the people had to have better transportation. Motor-generator sets were naturally used first, but the invention of the rotary converter followed as a matter of course. Then began a marvelous development in both of these pieces of equipment and in the apparatus for controlling them, which continues to this day. The rotary forced for a time the installation of 25-cycle generating machinery, for inherently the synchronous motor is a low-frequency machine. But other forces have been at work to counteract this, especially the necessity for making provision to utilize the same power plants for railway, industrial power and lighting services. Of these all but the first-named demand higher frequency, preferably 60 cycles. Now the tendency is towards 60 cycles for all purposes and the railway substation has been modified to meet the times.

Within the past few years have come all sorts of radical improvements in the substation. Automatic control is possibly the most spectacular, but this is only one of many; some at least were partly made neecssary by the advent of automatic control, others not. For example, there is the use of load-limiting resistance. This is a feature of automatic control, but it is useful almost anywhere. In the same category come the devices for preventing flashing at the converter commutator. And the improvements in starting qualities of converters must not be forgotten either.

But the subject is too large to permit here more than the pointing out of the high spots. The articles scattered through this issue give the details. They are worthy of careful study. They indicate that modern substation progress is something to be proud of.

The St. Paul Locomotives and Standardization

IT IS of exceptional interest to compare the locomotives which have been produced by the two electrical concerns manufacturing electric locomotives in the country, both to fit or satisfy the same general specifications and to meet the requirements of the Chicago, Milwaukee & St. Paul Railroad. How, we inquire, can we even expect standardization of design in heavy electric traction when such different machines will satisfy similar requirements and both be based on good engineering? And well may the question be asked. Here are two products, each of them a wonderful conception and accomplishment in itself. In neither of the locomotives is any really new practice present. The designing engineers state that they have followed proved theories of design in new combinations, to be sure, but not departing much from trails already blazed. Yet, on the surface and actually in many major details, the final products differ widely although each will undoubtedly prove thoroughly satisfactory in the service required. It is not unlikely, however, that time will show some weak points as well as the strong points of each type.

But does the fact that it is possible to build two admirable machines, though different, for the same service militate at all against a study of the desirability of standardization? It may be and probably is too early now to settle upon any standards in this line. We are yet in the development stage. But, if we needed an example of duplicate engineering which could be obviated if standardization were effected, this, it appears, is one. Cannot the electric railway industry study the question with a desire to find out if such standardization, not only in locomotives but in other equipment, is not desirable. Who would have said, years ago, that it would be possible to have a standard telephone transmitter and receiver which would be universally useful for communication between any two points on the earth? And yet that goal is almost reached. From the illumination field, take a leaf and with all the different reflectors and fixtures on the market, who would have thought standardization possible? And yet, the R.L.M. standard has been evolved for one field.

On the other hand, it is quite conceivable that these two locomotives are a step toward a realization of certain fundamentals of electrical locomotive design. The fact that these two companies are both producing equipment for one requirement and railway is of significance. The electric railway must look forward to the time when it has realized its every opportunity in the transportation scheme, and when it has there will be much more nearly universal use of electric locomotives and other electric motive power. There will be much interconnection of electric lines and interchange of electric equipment. Now is no time to revive any so-called "battle of systems," but is rather one of opportunity to work ahead toward the solution of the many problems in the realization of electric traction's greatest opportunities.

Should the Electric Railway Brain Workers Organize?

THE great war has produced as many topsy-turvies in our economic as in our political relations. One of the most impressive and depressive reversals is the way the intellectual worker has failed to keep pace with the cost of living in contrast to the manual worker who in some instances has actually outstripped the rise in cost. However, as generalizing on this subject is not new, it may be well to submit some truly startling figures from the monthly records of a large eastern electric railway.

Beginning with "general administration," we find that all the executive officers themselves averaged less than $14.50 per diem and their assistants less than $3.00 per diem. In the way department, all engineers, draftsmen, office employees, etc., below the rank of chief engineer and sub-division executives averaged $4.59 per diem, which princely stipend was just 3 cents more than that of the lyric, though illiterate tenors, who do their tamping, spiking, etc., in death march rather than jazz time. In the electrical department, the insiders, counting from the chief down, did a little better, but at that they were only 47 cents above the $5.40 a day averaged by the overhead linemen and similar workers. In the equipment department, we find that the men who do the planning, directing, testing and recording are stopped from enriching the alumni funds of their one-time universities because they average but $5.23 a day —just 7 cents more than is paid to the graduates of the Horny Hand Elementary School in the repair shop for their more personal researches in the nature of steel, iron, copper, oil, etc., before and after being railroaded. But our *piece de resistance* is in the transportation and traffic department. Dismissing the handful of superintendents and other higher officials with their lobster-diet pay of $7.84 a day, we note that the remaining supervisory officials, such as inspectors and dispatchers and the clerical staff, are an unlucky 13 cents a day below the $4.97 paid to the motormen and conductors.

The real inequality in the pay of brain versus brawn employees is much greater than the foregoing figures indicate. The brawn-worker is paid for an average of nine to ten hours a day. Overtime means more pay and often at a higher rate and he can't take his work home. The brain-worker's hours may nominally be less, but actually they are more for any man who likes his work, and most brain-workers are afflicted that way. Unpaid overtime whether in the office or in his home is a matter of course.

A further point to consider is that any increase in pay to the brain-workers means far less to the payroll than a like increase to the brawn-workers. On this particular property, the *intelligentia* are but 20 per cent of the total employees, even when all executives and departmental heads are included. The platform men alone constituted 57 per cent of all employees (there is no

power house staff) and commandeered 50 per cent of the payroll. Great is the power of organization for a common purpose.

Some may say that the answer to this is organization among the salaried workers. We do not think so, though to the company the spectre of a rapid deterioration and discouragement of the men who can do more to make or break their employer's interests than any other group whatever should be no less dangerous than that of organization. This much, however, is possible where these conditions prevail. For its own protection the company should bring these salaries as nearly as it can to an adequate standard and make the rest of the increase when its finances permit. The employees, on their side, should realize that their pay must not be gaged dollar for dollar with that of the track laborers and such other workers as have practically reached the limit of remuneration possible to them in railway work. The salaried man has a future before him and there is no limitation to the amount which he can earn if he demonstrates ability. The track-pounder is practically at the maximum of his earning capacity. The blame for the present state of affairs rests, of course, largely on the public which has not permitted rates sufficient to permit railway companies adequately to recompense their salaried employees. In many cases, we believe, it would be worth while for these men to bring their plight before the public at large for the reason that public understanding of and co-operation with electric railways will thereby be widened far more than by controversies concerning platform wages alone. It bodes ill for any industry when specialized training, experience and loyalty have to be so poorly rewarded as they are in the electric railway field at this very moment.

A Real Opportunity for Service to the Utilities

AT THE Cleveland meeting of the executive committee of the American Association an interesting presentation of the work of the Illinois Committee on Public Utility Information was made by its director. The executive committee took action which indicated practical interest in this movement which has already spread beyond the confines of Illinois. The Illinois committee is performing a useful function in supplying utility data to newspapers and other agencies for public enlightenment. The aim of the committee is to furnish simply the plain, unvarnished facts. The way in which city editors have used the material sent them, and a city editor is an eclectic individual, shows that the committee is rapidly ensconsing itself in their favor.

One of the latest enterprises is the issuing of a monthly speakers' bulletin, the first number of which is mentioned in our news notes this week. The bulletin is newsy and interesting. It can serve a useful purpose in stimulating good public speaking. If kept free from bias, as we understand is the plan, it will be of great assistance in promoting that condition so greatly desired—good public relations.

The cordiality of the reception of this work of the Illinois committee suggests the desirability of capitalizing the comparatively active public interest that has been awakened during the war and armistice period in the fate of the transportation utility. Good will is a company's best asset. It will pay to cultivate it, first by good service, then by good salesmanship.

Get Closer to Your Customers

A DEPARTMENT store proprietor who has been conspicuously successful in his business was asked recently to what factor he was most indebted for his prosperity. Was it because his prices were lower or his advertising so telling? As to prices, he replied that they were not always lower but that the goods were always exactly as described—a fact which bred confidence. So, too, his advertising had been a big factor in his success, not alone in the direct offering of his wares but also in the opportunities it gave him to talk to the public as a man of civic spirit on topics of general welfare. But there was still another factor, and that was his system of determining what complaints people had to offer against his service. The usual way of others in securing such information was to get it during the heat of the misunderstanding and to settle the argument on the basis of "The customer is always right." Of course the customer was not always right and would realize that fact on sober, second thought but too late to take the initiative in compensating the merchant or doing the right thing for the injured employee.

Feeling that the time to get at the truth is when the subject can be seen in perspective, this merchant has evolved a system of letters and personal calls through which past or prospective patrons are requested to suggest improvements in service or standards of quality in merchandise, or to mention incidents that led to their discontinuance of patronage. In this way he secures a large amount of dispassionate and constructive criticism that enables him to adapt his store to the standards set by the kind of customers he desires and to attain a much better relationship between his customers and his employees than would otherwise be possible.

If an electric railway were to follow the same policy, not necessarily in a house-to-house canvass but before groups of different classes of the population, it would be sure to learn much that would be beneficial. For example, it might be astonished to find that some of the business men know very well that the headways haven't been changed in years or the routes altered 1 in. despite the growth of the city. Here, then, is an opportunity to explain to them why it has not been possible to make such changes. Another man will ask why the community can't have faster and more reliable cars. He has had the impression all along that the local management was too fast asleep to know that such cars were to be bought. Here, again, is an opportunity to explain that if you can't pay interest on money borrowed in the past, you can't get anybody to loan you new money now.

In contrast to the numerous occasions where it is possible to show the other fellow that he has been unfair, it is likely enough that the outsider can point to many a fault that rarely if ever comes to the manager's attention by direct complaint. A man who has been passed up by a heedless motorman, may swear and grumble about the matter, but he is not likely to take his pen in hand to write a letter about it if he can get to his destination by walking. The railway is out a profit-bringing rider and there's an end to it. In one case, these heart-to-heart talks brought out the fact that nearly all complaints of this particular character came on the lines where only hand-brake cars were used, thus indicating that the use of the air brake would do more to settle the most frequent source of complaint than any number of admonitions and dismissals.

Noiseless Feature Is Effective in a Simply Constructed Substation

The Cooling Air Is Pulled Down Through the Converter and Muffled on Up-shoot Through the Transformers



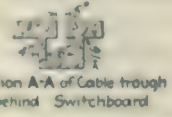
NOISELESS SUBSTATION SHOWING TRANSFORMER ROOM VENTILATION OPENINGS AT FLOOR LINE AND HIGH-TENSION LINE ENTERING AT CEILING

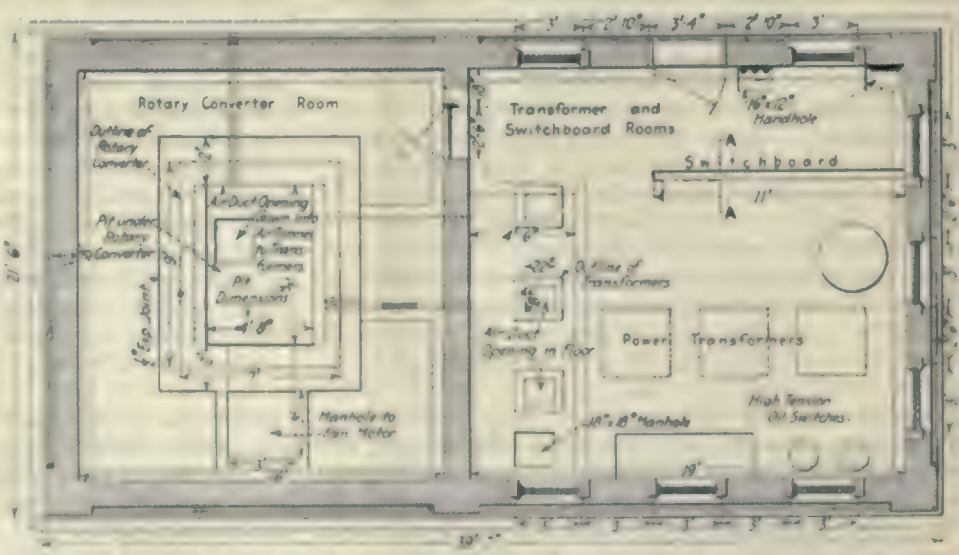


OPPOSITE SIDE OF SUBSTATION SHOWING OUTGOING FEEDER CABLES AND WAITING ROOM CONVERTED INTO CONFECTIONERY STORE

SOME time back the Birmingham Railway, Light & Power Co., found it desirable to install a 500-kw. railway substation at a point within the city where the Gate City, East Lake and Tidewater lines intersect. This intersecting point was very close to the actual load center of the section of the system it was desired to serve. A piece of property at this location was available and the company erected a substation and placed it in operation. This load center was also in a good residential section, and it was not long before the noise of the rotary converter brought such a protest from the surrounding neighbors that it became necessary to move the substation to another point. A point near the end of one of the intersecting lines was selected as the most desirable of the available locations, but this was so far removed from the load center that it made the line losses very heavy and the voltage regulation unsatisfactory. From an economic standpoint it was therefore decided that it was necessary to have a substation located at the load center previously chosen, and so the engineering department, of which L. L. Newman is the chief and H. E. Cox is assistant, set about the task of designing a noiseless substation. The desired result was simply yet most effectively attained in the new Woodlawn substation.

In working out the design it was assumed that the transformer cooling air leaving the building was largely responsible for transmitting the noise of the rotary converter. The substation was therefore built in two rooms, one room for the converter being sealed up tight except for an opening in the roof, and another room for the transformer, switchboard, etc., which has a door and windows, but these are kept closed. The cooling air for the transformers is drawn in through a cupola in the roof of the converter room by a motor-driven fan placed in the pit underneath the converter. The air is thus drawn down through the converter and forced down into a tunnel beneath the floor of the converter pit and thence through this tunnel to three openings in the floor of the other room, up through the three single-phase transformers and out through





FLOOR PLAN OF THE WOODLAWN SUBSTATION SHOWING THE LOCATION OF THE VARIOUS PIECES OF EQUIPMENT

the cupola in the roof of this room. Passing the air through the station in this manner gives the noise of the converter carried with the air stream an opportunity to be diffused or muffled as it passes up through the transformers. And as the air leaving the cupola of the transformer room might still carry some noise, the roof of the cupola is so constructed as to deflect the stream of air down against the roof, and the coping, projecting 18 in. above the top of the roof, then reflects it upward. The transformer coils have apparently made a most effective muffler, or if the noiselessness cannot be attributed to this alone, at least the scheme as a whole has been a complete success.

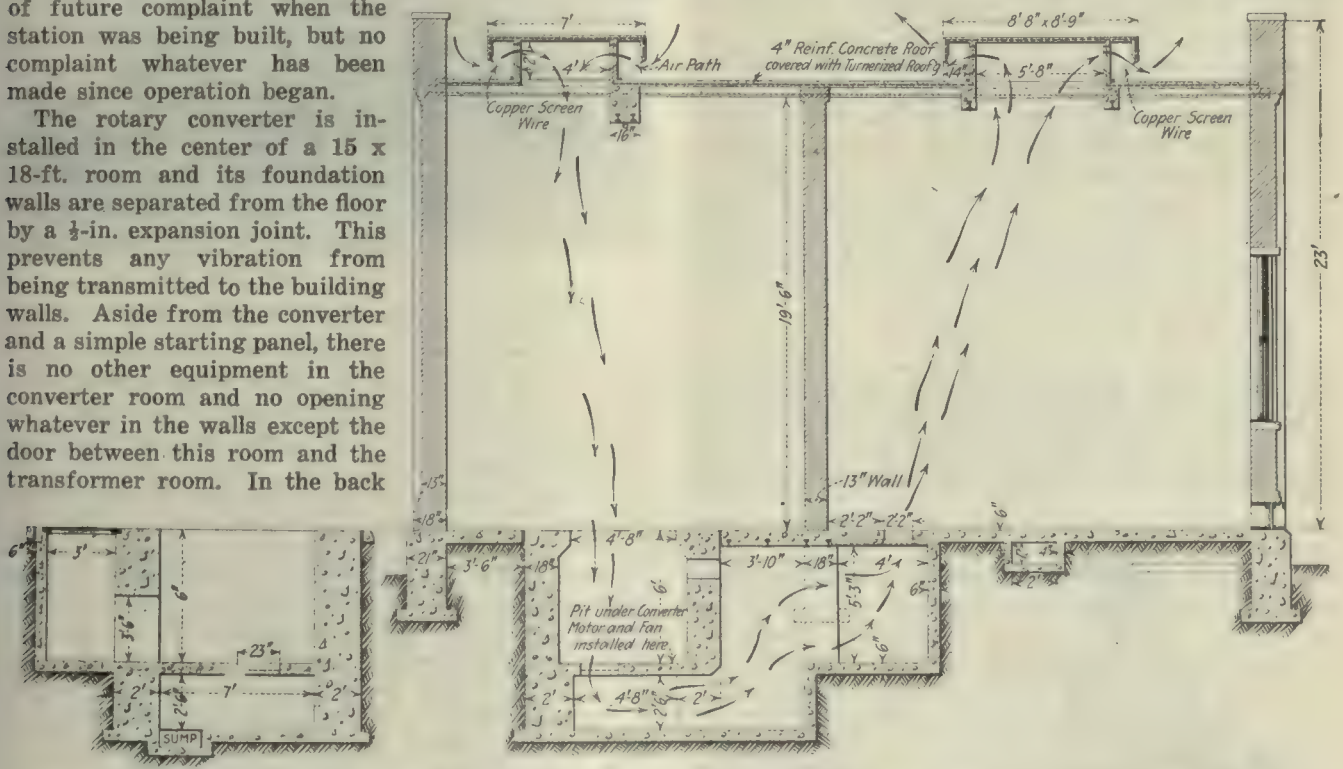
The 1,000-kw. rotary now installed in the station cannot be heard at all 15 ft. away from the building walls. The people in the neighborhood gave warning of future complaint when the station was being built, but no complaint whatever has been made since operation began.

The rotary converter is installed in the center of a 15 x 18-ft. room and its foundation walls are separated from the floor by a ½-in. expansion joint. This prevents any vibration from being transmitted to the building walls. Aside from the converter and a simple starting panel, there is no other equipment in the converter room and no opening whatever in the walls except the door between this room and the transformer room. In the back wall of the transformer room an opening was arranged for use in case it was necessary to remove the converter. This was done by placing a rail in the wall horizontally as a beam, and bricking in the space below so that the bricks can be readily knocked out.

The air intake openings in the cupola are covered with fine copper mesh to prevent water and dust from being drawn in. The construction of the pit underneath the converter and the air tunnel can be clearly seen in the accompanying drawing. Entrance to the converter pit for inspection of the fan and motor is made through a manhole at one side of the foundation and through an opening in this wall.

The starting panel for the converter is located in the converter room just inside the door between the two rooms, so that the operator can throw the starting switch over to the full voltage side at the moment he sees that the voltage has come up right as indicated by the voltmeter at the far end of the switchboard in the other room, the converter being started up with open field as an induction motor. There are no meters whatever in the converter room.

The cupola over the transformer room is built and equipped the same as that over the converter room except that it is larger. The transformer and switchboard room is also equipped with eight 12 x 18-in. openings in the walls at the floor level for ventilation purposes, in order that the doors and windows may be kept closed in warm weather to keep down the noise. These were equipped with grating so that the amount of opening could be regulated. They were placed at the floor line on the theory that the heat within the room would cause the air to enter here, rise and exhaust through the ventilators in the roof. However, it has been found that the transformers muffle the noise of the converter so completely that it is even possible to leave the windows and doors in this room open in summer without disturbing the neighbors.



CROSS-SECTION THROUGH NOISELESS SUBSTATION SHOWING PATH OF COOLING AIR THROUGH THE STATION

The location of equipment in the transformer and switching room is shown in the accompanying drawing. The transformers were logically placed along the wall between the two rooms in order to make the air tunnel as short as possible. The switchboard was placed near the front of the room so that the bracket-type voltmeter could be seen from the converter room during the starting of the machine. While the high tension oil switch was installed at the rear of this room where the high tension line enters the substation, the switch rod was extended through a 24-in. x 12-in. tunnel underneath the floor so that the operating lever and panel could be placed on the same line as the switchboard. Provision for a second oil switch similiarly installed and three power transformers was also made.

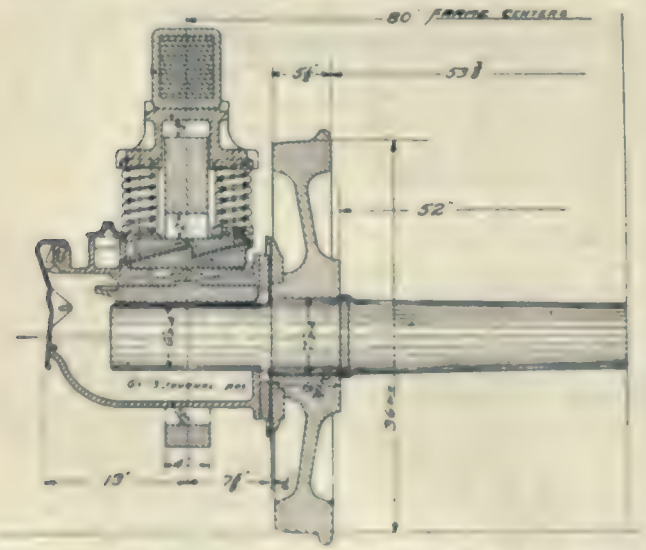
A small waiting room was built at each end of the substation for the convenience of the car riders. One of these rooms has recently been converted into a small confectionery store and the sale of soft drinks and candies, etc., has made the construction of the waiting-room addition to the building a profitable investment.

The Two Designs for the C., M. & St. P. Locomotives*

A. F. Batchelder and S. T. Dodd of the General Electric Company and N. W. Storer of the Westinghouse Electric & Manufacturing Company Give Details of the Two Designs to Meet the Chicago, Milwaukee & St. Paul Railroad Specifications—Some New and Individual Characteristics Are Emphasized

THE Chicago, Milwaukee & St. Paul Railroad electrification of the 440 miles of line from Harlowton, Mont., to Avery, Ida., proved sufficiently successful to convince the railway of the economic advantages of electric operation. As a logical consequence, as has been previously noted in these pages, the company decided to equip an additional section over the Cascade Mountains between Othello and Tacoma, Wash., a distance of 212 miles. In the summer of 1917 the railway issued specifications covering the apparatus required on account of this additional electrification and a contract for part of the locomotives was given to the General Electric Company and for the others to the Westinghouse Electric & Manufacturing Company. These locomotives are being delivered and put into service.

Engineers of the two companies, men who had much to do personally with the development of the locomotives, presented details of the two locomotives with some analysis of the reasons entering into the designs at the Pittsburgh meeting of the A. I. E. E. The ELECTRIC RAILWAY JOURNAL has published† data and



JOURNAL BOX SHOWING WEDGES TO GIVE RESISTANCE TO LATERAL MOVEMENT. GENERAL ELECTRIC LOCOMOTIVE

other information regarding both of these locomotives from time to time. The publication of the abstracts of the papers presented at Pittsburgh serves to complete the descriptions and at the same time affords an opportunity for a comparison of the two designs.

The Chicago, Milwaukee & St. Paul Railroad specifications required that the locomotives be built for a



CHICAGO, MILWAUKEE & ST. PAUL PASSENGER LOCOMOTIVE, GENERAL ELECTRIC CO.

power supply at 3,000 volts direct current. The load specified was a train of twelve steel coaches, making a total weight of 950 tons. The limiting grades are 2 per cent, compensated, for a distance of 20 miles from Piedmont to Donald on the east slope of the Rocky Mountains, and 2.2 per cent, compensated, for 17.8 miles from Beverly Junction to Boylston on the western division. The curvature of sharpest curve on the main line is 10 deg., but the locomotive must negotiate a 16-deg. curve in the yards satisfactorily. Speed requirements were set at approximately 25 m.p.h. up a 2-per cent grade, and approximately 35 m.p.h. up a 1-per cent grade, with a maximum speed of 65 m.p.h. for safety. Trains on down grades were to be held at speeds consistent with safe operation by means of regenerative braking.

It was further provided that the locomotive be equipped with an oil-fired boiler to be supplied by the railway, to furnish steam for heating the train. Storage capacity was required for 30,000 lb. of water and 750 gal. of fuel oil. Apparatus was also required in the locomotive for lighting the train and charging the train storage batteries at a voltage of from 60 to 85.

With these general statements as an introduction, the abstracts will now be given:

The General Electric Locomotive

BY A. F. BATCHELDER AND S. T. DODD

THE locomotive as completed and delivered by the General Electric Company is shown in an accompanying illustration, while another shows an outline drawing of the side elevation, giving some general dimensions. It will be seen that the running gear is composed of four individual trucks, the two end trucks having three axles each and the two center trucks having four axles each. These trucks are connected by special articulation joints. The motor armatures are mounted on the axles and the motor fields are carried on the truck frames.

*Abstracts of papers presented before the Pittsburgh Meeting of the American Institute of Electrical Engineers, March 12, 1920.

†See issues for March 23, 1918, pp. 559 and 561; Nov. 1, 1919, p. 827, and Jan. 3, 1920, p. 36.

The superstructure is made in two sections of similar design, with a third section between them. The third or central section contains the train-heating equipment, which consists of an oil-fired steam generator, together with water and oil tanks. This unit is complete in itself and is carried over supports attached to the middle two trucks. It can be readily removed for repairs without interfering with any other part of the locomotive. It is placed between the two operating cabs in order to be easy of access to the engineer's helper or fireman, from either location.

The end sections are similar in appearance. The



CHICAGO, MILWAUKEE & ST. PAUL PASSENGER LOCOMOTIVE, WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

operator's cab in either section is on the inner end next to the heater cab above described, having been so placed in order that the operator can be convenient to the heater and to allow a maximum space for apparatus in the apparatus cab or outer end section. Another advantage of this arrangement of cabs is that the operator can have access to any section of the locomotive requiring his presence without passing through a section containing high-tension apparatus. The engineer's or operating cab contains a main or master controller, the air-brake valves and handles and an instrument panel with air gages, ammeters and speed indicator. The engineer uses either of the two operating cabs, according to the direction in which he is running.

A door gives access from the operating cab to the apparatus section, which extends with a curved top to the extreme end of the locomotive. This construction adapts itself naturally to the protection of the apparatus included and, in addition, allows a clear view for the operator from his normal operating position. Contained in this apparatus section are the resistors and contactors for control of the power circuits of the locomotive. The starting resistors are placed in two rows on each side of the central passage just above the floor of the superstructure. They are covered at the sides by removable covers, which when opened allow the separate resistor boxes to be slid out upon the longitudinal running board outside the apparatus cab. The air compressor for the air brakes, the motor-generator set for the train lighting and the storage battery for marker lights and emergency control stand upon the same level as the resistors and can be removed or replaced in a similar manner. Above the resistors are located the contactors with their arc chutes facing a central aisle 2 ft. wide. This allows ample arcing space and room for inspection of contactors. Above the contactors is the curved roof of the locomotive with trap doors for inspection of the back connections and insulation and for removing the contactors in case replacement is necessary. The whole design and arrangement of this apparatus cab lends itself to economy of cost and material, as well as to convenience of inspection and repair of apparatus.

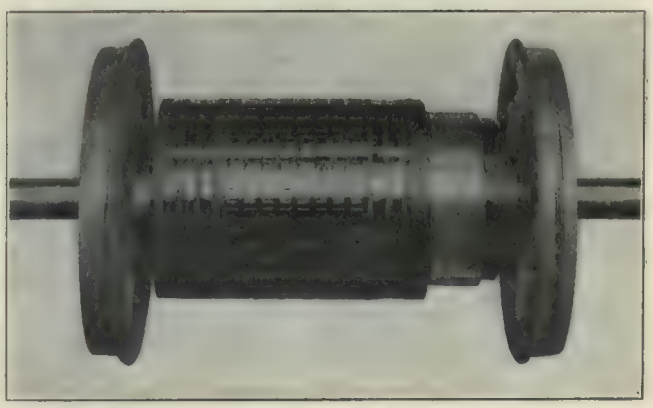
THE GEARLESS MOTORS ARE OF THE BI-POLAR TYPE

The motors are of the bi-polar gearless design which was adopted for the New York Central Railroad locomotives. To insure light weight per axle, flexibility in control and good truck arrangement for curving as well as for high-speed running, twelve motors were used, each of relatively small capacity. They are especially designed to withstand high temperature, being insulated with mica and asbestos.

The motor armature complete was built directly on the axle with the wheels pressed and keyed in place. The continuous rating of each motor at 1,000 volts and with 120 deg. rise, measured by increase in resistance, is 266 hp., corresponding to 3,500 lb. tractive effort at the rim of the drivers at a speed of 28.4 m.p.h. Forced ventilation is employed for cooling, and the armature core is provided with holes for the passage of ventilating air. Ventilating blowers are located above the motor armature. Air is delivered at the commutator end of the motor where it divides, a part passing through the armature and a part back through and around the field coils where it escapes upward and is afterward used for ventilating the starting resistors.

Besides having no journal bearings or gearing, this type of motor has the advantage of simplifying and making compact the locomotive design, as use is made of the frame to furnish the return path for the magnetic flux. With this construction the magnetic flux passes horizontally in series through all twelve motors, having a return path through the locomotive frame. Large surfaces in contact are provided in the articulation joints, thus giving an easy path for the flux. The polepieces are made flat to prevent them from coming in contact with the armature during its movements.

In the control equipment electro-magnetic control is



GEARLESS MOTOR ARMATURE AND DRIVING WHEELS, GENERAL ELECTRIC LOCOMOTIVE

used for single independently-operated switches, but electro-pneumatic cam control is used for operating banks of switches.

Four combinations of motors are provided for motoring. The first is with twelve motors in series, the second with six motors in series and two sets in multiple, the third with four motors in series and three sets in multiple, and the fourth with three motors in



ONE-HALF OF RUNNING GEAR, WITH MOTORS MOUNTED. WESTINGHOUSE LOCOMOTIVE

series and four sets in multiple. In each combination there is one tapped-field step in addition to the rheostatic steps, thus giving eight operating speeds exclusive of the thirty-one resistance steps.

For regeneration, some motors are used to excite the fields of the others, which in turn are used as generators to return power to the line.

As a provision against short circuits or extreme overloads, a quick-acting circuit breaker is provided in the apparatus cab which will protect the circuit in less than $\frac{1}{100}$ of a second.

MECHANICAL CONSTRUCTION DESIGNED TO PROVIDE FLEXIBILITY

For flexibility in curving the running gear is made up of four trucks, each of a relatively short wheelbase. The middle two trucks have four driving axles each, and the two end trucks, two driving axles and one guiding axle each, making a total of fourteen axles. The trucks are connected together with articulation joints which allow of no relative lateral movement between them, so that each truck positively leads the following truck. This is for the purpose of reducing flange wear on curves and lateral oscillation on tangent track.

It is felt that with a wheelbase which is as long as the present one (67 ft.), the use of articulated trucks allows the locomotive to accommodate itself most satisfactorily to track curvature, at the same time minimizing lateral oscillations on tangent track.

To care for any lateral blow which might, however, be given against the rail head the leading and trailing axles are allowed a movement of $\frac{1}{4}$ in. relative to the truck frame either way from their central position. This movement takes place against a resistance introduced by wedges above the journal boxes. This wedge construction is shown in an accompanying illustration. Further protection of the track from lateral displacement on the ties is provided by carrying the outer end of the superstructure on rollers, bearing on inclined planes upon the truck frames. By this construction the leading and trailing trucks tend to maintain their central position and the weight of the superstructure is best distributed so as to increase the adhesion of an affected rail to its tie.

The Westinghouse Locomotive

BY N. W. STORER

Accompanying reproductions of pictures show views of the completed Westinghouse locomotive, and an outline cut-away drawing shows the general arrangement of the interior, as well as the exterior. The running gear consists essentially of two Pacific-type running gears coupled back to back. One half of the running gear is shown in another illustration. The side frames are steel castings, joined over the four-wheel trucks by a heavy A-frame casting; also by heavy cross-ties between the drivers, which also support the motors and carry the center pin and the coupling between the two running gears. Each half running gear has six spring-supported plungers on which the cab rests. There are two supports at each end and two in line with the center pin. By the use of shims, the distribution of weight between the two ends of each running gear may be adjusted as desired. The coupling between halves consists of a long bar of a box section.

The superstructure consists of one long cab built so strong and rigid that it can be lifted at the ends. It is light but stiff. The cab is divided by cross partitions into compartments, one at each end for the engineer and the others for the several parts of the cab equipment.

In the middle cab, and occupying relatively a large portion of space, are located the steam boiler and the water storage tanks. The fuel oil tank is located beneath the boiler and the two water tanks are placed just fore and aft of the boiler.

TWIN DRIVING MOTORS ARE USED

The six driving motors are of the twin-armature type, that is both armatures are contained in a single frame arranged to secure the maximum economy of weight. The fields are of the standard four-pole type with four salient poles and four inter-poles for each armature. Each armature is wound for 750 volts, but fields and armatures are connected permanently in series so that the rating of the complete motor is based on 1,500 volts.

The one-hour rating is 700 hp., based on the A. I. E. E. rules, and the continuous rating 567 hp., with forced ventilation and 400 hp. without blowers.

Twin motors were adopted to reduce space used by gears, to reduce locomotive weight, to make the most efficient use of available space and to secure the advan-



OUTLINE DRAWING OF GENERAL ELECTRIC LOCOMOTIVE

tage of low-voltage armatures. Motor capacity was fixed by the number of axles, six being selected as the smallest number that could be used under the limitation of weight on the drivers. This led to the adoption of the double Pacific type of running gear with its excellent riding characteristics. An illustration shows the pinion end of the twin motor.

Fans mounted on the motors give them a high continuous rating without the use of forced ventilation, and it is expected that the blowers will not have to be used with normal train load except on heaviest grades.

Quill drive, similar to that used on the locomotives of the New York, New Haven & Hartford Railroad was adopted.

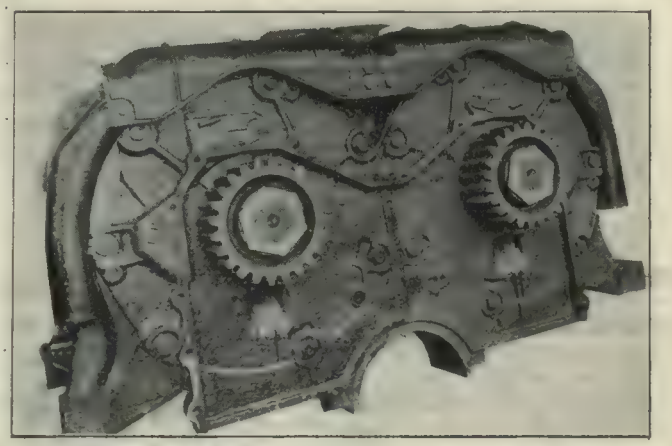
SOME FACTS REGARDING THE CONTROL SYSTEM

An accompanying illustration shows a schematic diagram of the main motor circuits and another diagram gives the details of a single motor with its exciter and resistance. Three combinations of motors are possible; first, six motors in series; second, three in series, two sets in parallel, and third, two in series, three sets in parallel. By the use of inductive shunts on the fields of all three of these positions nine running speeds are possible, in addition to the thirty-three resistance steps available. One feature of the resistance arrangement is that the same resistance groups and switches are used for all of the three combinations. All switches are electro-pneumatically operated, some individually and some in cam groups.

Illustrations are given, also, to show the master controller open and the top view with the control levers. An interlock in the controller prevents the line switches from closing when the motor connection is in the second or third position, unless the engineman knowingly pushes a button in the top of the master controller. When applying current with the locomotive at speed this button must be pressed when it is desired to go immediately into the second or third combination.

For regeneration, the motors are separately excited from two axle-driven generators carried on the inside axles of the two four-wheel trucks and geared to them like ordinary interurban railway motors. These generators are separately excited and the field strength of the main motors is controlled by varying the fields of the exciters.

The scheme used for regeneration includes the use of stabilizing resistance, which is connected in series with the exciter armature, with the main motor field

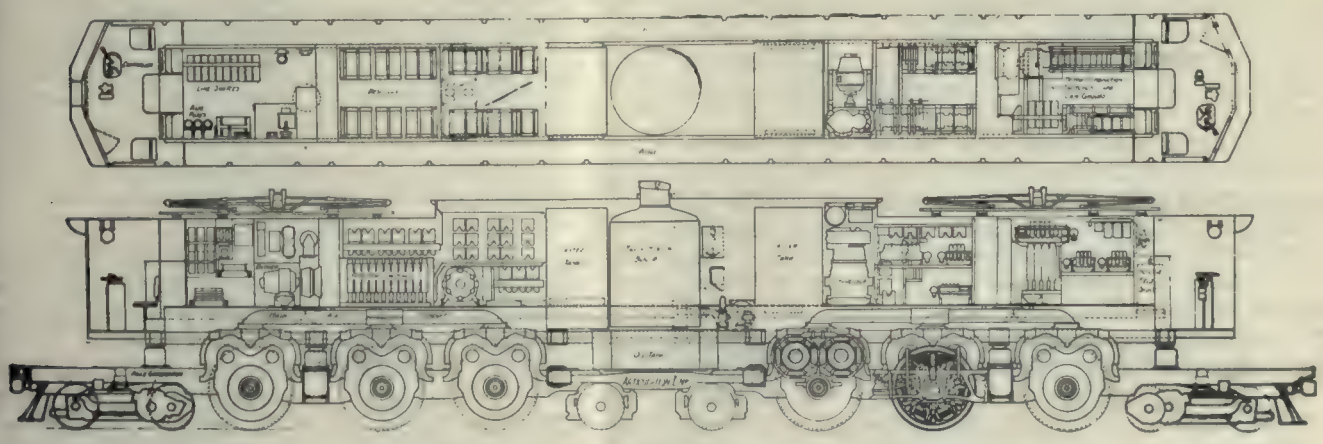


TWIN MOTOR FOR WESTINGHOUSE LOCOMOTIVE

circuit and also with the main motor armature circuit, so that the field excitation is dependent, to a certain extent, on the armature current.

One feature was to provide for beginning regeneration at any speed within the normal running range without having a heavy current in either direction that would produce a surge in the train. This was accomplished by providing that the motors should never be connected to the line without the maximum starting resistance in series between motors and the line. This, of course, is provided for in motoring, but is necessary also in regeneration to prevent undesirable surges. With the 17 ohms resistance provided on the first step, the maximum current that could flow from the line would be less than 200 amp. with no voltage generated in the motors. The resulting torque is negligible, particularly if this current is divided among two or three circuits, as would be the case in the second or third combinations.

The stabilizing resistance protects the motors against sudden changes in line voltage, while the axle generators protect against variations in grade, which would otherwise tend to vary the speed. In case of a sudden reduction in line voltage, which would be followed by a heavy increase in the regenerated current, the increased voltage drop in the stabilizing resistance resulting from this immediately cuts down the field current and the voltage generated by the main motor sufficiently to limit the increase in regenerated current to a safe value. Similarly the axle-generator regulation takes care of the passage of a train from a sharp curve to a tangent.



SIMPLIFIED PLAN AND LONGITUDINAL VERTICAL SECTION OF WESTINGHOUSE LOCOMOTIVE

The chief auxiliaries provided are a motor-generator set which draws current from the line and delivers current at a constant voltage of 85; a storage battery of thirty-eight cells with a one-hour capacity of 300 amp., and two axle-driven generators for the primary purpose of furnishing excitation for the main motors during regeneration.

STEAM LOCOMOTIVE EXPERIENCE APPLIED IN MECHANICAL DESIGN

In the design of this locomotive the attempt was made to obtain those mechanical features which have developed through years of experience with steam locomotives. The desirable features are location of the mass as close to the center as possible, high center of gravity of that part of the locomotive carried on the running gear, as long a rigid wheelbase as possible, guiding trucks located well outside the mass of the running gear, equalization to secure stability, minimum permissible restriction of free movement of each axle and portion of the running gear and large driver diameter. In the cab it is very advantageous to concentrate heavy equipment between the center pins. In the running gear the closer the weight is concentrated to the center pins the less tendency there is to nose and the easier the duty on the wheel flanges and track.



TOP VIEW OF WESTINGHOUSE MASTER CONTROLLER

This locomotive embodies all the foregoing features to a remarkable degree. Particular attention was given to weight distribution. The cab has the boiler, water and oil tanks, storage batteries, air-compressor, resistors, motor-generator set and the heavier parts of the control equipment concentrated between the center pins. The driving motors are mounted above the axles on the running gear, thus getting the weight well inside the wheelbase, but placing it relatively high. The height of the center of gravity of the complete locomotive is 68 in., a value that compares well with that of a steam locomotive.

The Pacific type of running gear with its long rigid wheelbase and the guiding trucks is a particularly stable design and is especially good with the weight distribution that obtains on this locomotive. The height of the center of gravity of trucks with motors mounted is 43½ in.

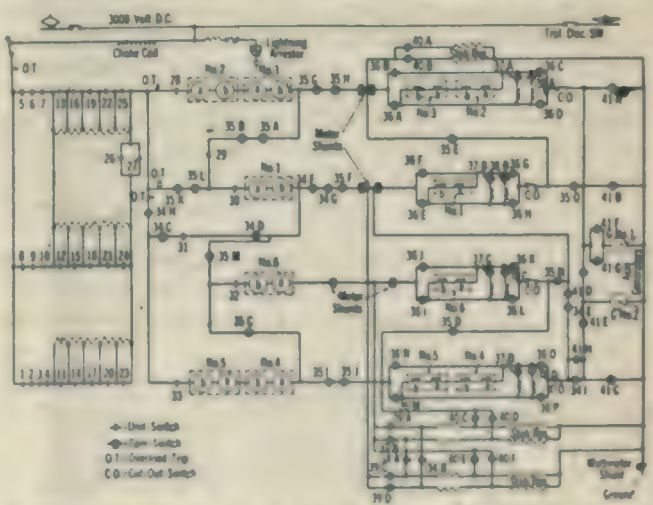
The quill drive, which is a further development of the one used on the New Haven locomotives, gives each driving axle perfect freedom to move vertically the full distance permitted by pedestal jaws without affecting the motors or frames, except through springs. The only "dead" weight carried is the weight of wheels, axles, journal boxes and spring clamps.

Great effort has been made to cushion the locomotive against shock, either while running or from bumping. The apparatus in the cab is especially well protected, since the cab rests on spring-supported plungers which are in series with the main semi-elliptic springs. The cab is protected against bumping strains by floating center pins, which, while held rigidly against lateral motion, are cushioned against longitudinal motion by heavy springs. It has been the practice heretofore with this general type of locomotive to have one center pin rigid in the running-gear frame and to allow the other to move freely in a longitudinal direction. It was considered best in this machine to allow a slight relative motion between the two center pins, but to prevent the bumping shocks by spring cushioning.

NOTES ON THE ELECTRICAL DESIGN

The efficiency of the twin-motor unit with both armatures operating to drive the same gear has been shown by factory tests to be materially higher than that calculated by the A. I. E. E. rules from "no load" losses and the fixed percentage of losses for gears and other load losses. These tests show plainly that those losses assumed for the Institute rules are too high for large motors.

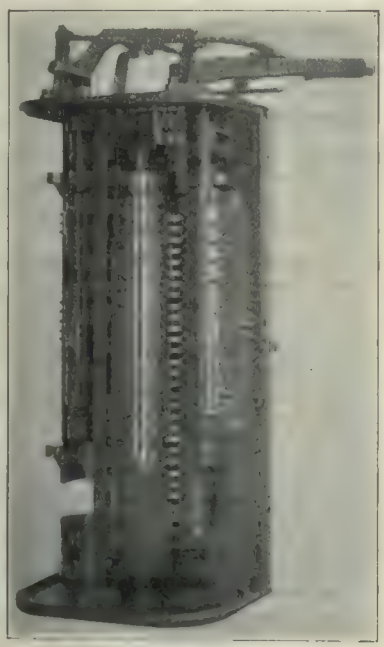
Past practice with direct-current motors has been to use the series-parallel arrangement, or at most, series, series-parallel and parallel, giving one-quarter, one-half and full speed. With six motors and twelve armatures on 3,000 volts the regular series-parallel control could have been obtained in several ways, but the method adopted gives as simple a control as any system for regular series-parallel arrangement and in addition has the great advantage of the three-speed locomotive for handling the service. The one-third and the two-third speed arrangements cover the range so much better than the one-half speed, or than the one-quarter and one-half speeds, that there is scarcely any comparison possible. The one-half speed is too low for a running speed and too high for switching. The one-third speed is an excellent switching speed, and the two-thirds speed is a good running speed, especially good for regenerating on heavy grades. Another advantage lies in the decreased rheostatic losses as compared with those in the ordinary series-parallel control. These losses are further reduced by two field shunting positions on each combination.



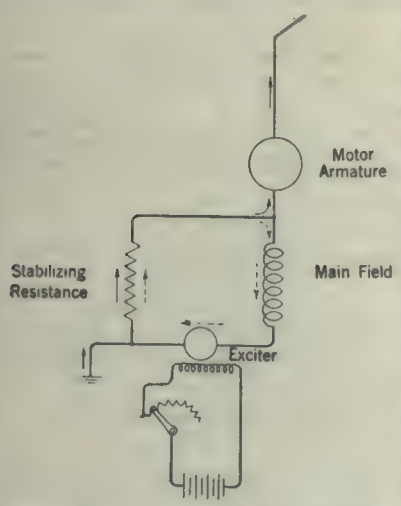
SCHEMATIC DIAGRAM OF MAIN MOTOR CIRCUITS, WITH RESISTANCES AND EXCITERS, WESTINGHOUSE LOCOMOTIVE

One of the fundamental principles on which this locomotive was designed was that the motor circuit should not be opened, either in normal operation or under emergency, until the current had been cut down

by the introduction of resistance. This is considered a very valuable, if not an absolutely necessary feature. The effect is not only to divide the arcs among a large number of switches and, therefore, to promote safety, but the generation of high voltages from suddenly rupturing a heavy current is prevented. In order to avoid high-voltage troubles in the auxiliaries it was the policy on this locomotive to limit the high voltage to the minimum possible number of circuits and the minimum amount of apparatus. It was impossible to avoid it altogether on the moving apparatus, due to the fact that the train lighting must be supplied for hours at a time in case of any emergency when the train is held up by a wreck or storms. The motor-generator set, which is designed primarily for this purpose, is the only piece of moving apparatus among the auxiliaries which has the high voltage applied to it. The voltage selected for the auxiliary circuits was primarily determined by the voltage required for train lighting. While 85 volts is lower than would otherwise be selected for the auxiliary motors, it is perfectly safe and is a voltage that is so low that the motors can be forgotten, as far as the questions of insulation and commutation are concerned. The auxiliary motors are, of course, very much smaller than they would be if the high voltage were applied to them. A storage battery, from the standpoint of operation, is, of course, always a desirable thing on a locomotive. The combination of the storage battery and the axle-generators will furnish ample auxiliary power to take a locomotive to the end of a run, if the motor-generator set fails. The same combination will take a train safely down the longest and steepest grade with the air brakes, if power is for any reason cut off the line. If the train is going up a grade and power is cut off the battery will furnish air to hold the train with the brakes for a considerable time, so that it will not be necessary to block the wheels, as is the ordinary practice, unless power is off for a considerable time.



WESTINGHOUSE MASTER CONTROLLER



SCHEMATIC DIAGRAM OF SINGLE MOTOR, EXCITER AND RESISTANCE. WESTINGHOUSE LOCOMOTIVE

In general, wherever possible on the locomotive standard industrial types of motors have been employed for the auxiliaries.

Comparative Characteristics of the Two Locomotives

The following table, which gives a summary of the principal dimensions and characteristics of the two locomotives, is of interest in indicating the manner in which the two manufacturers have met with their individual systems of design the general specifications of the railway for these locomotives:

DATA FOR THE ST. PAUL LOCOMOTIVES

	General Electric	Westinghouse
Total weight	521,200 lb.	550,000 lb.
Total weight on drivers	457,680	336,000
Length over-all	76 ft. 0 in.	88 ft. 7 in.
Height over cabs	14 ft. 11½ in.	14 ft. 6 in.
Height over pantograph, locked down	16 ft. 8 in.	16 ft. 7½ in.
Total wheelbase	67 ft. 0 in.	79 ft. 10 in.
Max. rigid wheelbase	13 ft. 9 in.	16 ft. 9 in.
Diameter of driving wheels	44 in.	68 in.
Diameter of idle wheels	36 in.	36 in.
Heater capacity	4,000 lb. steam per hr.	4,000 lb.
Water capacity	30,000 lb.	25,500 lb.
Oil capacity	6,000 lb.	750 gal.
Compressor capacity	150 cu.ft. per min.	150 cu.ft. per min.
Number of motors	12	12
Type of motor	(Bi-polar) GE-100	(Twin) 4-pole Westinghouse

Locomotive Rating:	General Electric Tapped Field	General Electric Full Field	Westinghouse
Total horsepower, 1-hour motor rating	3,480	3,380	4,200
Total tractive effort one-hour motor rating	36,000	46,000	66,000
Speed, miles per hour	36.2	27.5	23.8
Total horsepower continuous	3,200	3,200	3,360

Substation Operation for Street Railway Service*

The Author Gives the Results of Practical Experience with Three Types of Transformation Apparatus

BY W. T. BIVINS
Chief Engineer of Electrical Equipment United Railroads of San Francisco

SUBSTATION operation for street railway service should be placed in the heavy-duty class. The design of the building and equipment should be made with a view to economy and simplicity of operation, so as to minimize the necessary number of attendants. Due regard, however, should be given to possible future extensions.

For transforming high-voltage alternating current to direct current for railway work, the choice in converting apparatus usually narrows down to synchronous motor-generators, induction motor-generators and rotary converters. On this system all three kinds are used, the largest stations being equipped with motor-generator sets. Where high efficiency, overload capacity, compactness and low initial costs are of greatest importance, the synchronous converter is apparently the most desirable piece of apparatus available, it being understood that the alternating-current feeder-line conditions are favorable and free from severe surges, rapid fluctuations in frequency, excessive ohmic drops, etc.

*Abstract of paper read at Third Annual Electric Railway Night of Pacific Railway Club.

Where such unfavorable conditions obtain, however, the induction motor-generator is preferable.

On our system we find that there are times when the inherent characteristic of fixed ratio of alternating-current to direct-current voltage is objectionable, due to shifting of load centers. To cite an instance: In the Richmond district we have a small rotary substation supplying the major portion of energy to the Beach, Park and Cliff lines. This station is of ample capacity for all ordinary purposes, but for an occasion like the arrival of the "Fleet" in the harbor, when everybody in San Francisco wanted to go to the beach, this station would be overloaded, thus necessitating relief by some change in the direct-current feeders. If this substation equipment had consisted of motor-generator sets, we should simply have lowered the direct-current voltage and permitted other stations operating in parallel to feed in and help to carry the abnormal load occasioned by the close headway. At the same time a suitable trolley potential for operating the cars would have been maintained. This is a concrete instance where motor-generator sets would be preferable to the synchronous converter.

Voltage control can, of course, be arranged for by the use of extra apparatus for controlling the alternating-current voltage. I believe that the induction regulator is now being used more generally than any other means for voltage control in connection with synchronous converters. However, any such apparatus adds to the initial cost and some of it is dangerous to operate, owing to risk of short circuits.

On our system we have observed that the 60-cycle rotary converter will flash over from positive to negative brush arm, in case of a ground in proximity to the station, much more readily than the motor-generator sets. In fact, we have had considerable trouble from this source with broken trolley wires on the rail, and are now considering the installation of a new type of quick-acting circuit breaker, along with arcing screens.

Our experience has shown that the relation of trolley taps to the source of power is of great importance, for a "close-up" ground will invariably damage the circuit breaker even though the machines do not "buck" over. The line losses due to tap distances are immaterial, when compared with the loss through flashovers, including delays to the service and expense involved in repairing damaged apparatus.

While the rotary converter has somewhat less stability than the synchronous and induction-motor-driven sets, its efficiency, including transformers, is from 6 to 8 per cent better than that of a like motor-generator set without transformers. The motor-generator set, however, has some very desirable features not found in the synchronous converter, such as its possible use by over-excitation for power-factor control. The induction motor is not easily thrown out of phase, and accordingly is very desirable in some classes of work. However, it is at a disadvantage because it has no power-factor control. Comparing all three kinds of converting apparatus, my observations and experience have been that the synchronous motor-generator set is preferable for railway service.

A question which often arises is as to the choice in size of units for a substation. In my opinion, medium-sized units are preferable, space permitting, because better economy can be secured by cutting in and out machines to follow the load. Furthermore, with large units if one becomes incapacitated, a serious overload is usually imposed upon the other machines. With the present high generating cost, it seems even more necessary than ever closely to watch the apparatus to see that no more units are in service than necessary.

In connection with troubles encountered in the upkeep of direct-current generators, the most bothersome are those connected with the commutator. Excessive sparking will usually be found due to some defect in the field or the armature, some external electrical trouble, or more likely a trouble in the commutator, where it is sometimes difficult to identify. Field troubles usually consist of partial short circuit in one coil, unequal air gaps, series fields connected by mistake so as to oppose the shunt fields, or an error in rewinding a coil. Any of these troubles electrically unbalance a machine and cause short-circuit currents with resultant sparking. The more common troubles in an armature causing bad commutation are partial open circuit and short circuit in some portion of the winding. We have also experienced sparking in a less degree due to high resistance between the end of a coil and the commutator riser. As for the commutator, sparking is usually caused by operation of brushes at wrong commutation points, incorrect brush spacing, spanning of too many bars by brushes, lack of parallelism of brush arms with commutator bars, and, last but not least, high mica.

On our system at one time we had a lot of commutator trouble from high mica, particularly in one 9,000-kw. substation, which was heavily overloaded during the Panama-Pacific Exposition. The so-called "skin" or hard finish of the commutators was burned off by overload, after which the commutator bars were soft and the mica hard, occasioning constant stoning to keep the machines operating. Some 1,500-kw. motor-generator sets were stoned two or three times a day. After trying all sorts of brushes we finally decided to undercut the mica, which we did with a tool designed and built in our own shops. This ended our troubles. The machine, which had always given commutator trouble and had been trued up by the manufacturer after installation has, as this paper is written, been running off fifteen months since it was slotted, during which time we have practically disregarded the commutator. Special brushes designed for use with slotted commutator are employed, and these require no oiling and, therefore, seldom need cleaning. These brushes have little or no abrasive characteristics and have worn but little in fifteen months, while the wear of the commutator is practically nil.

Statistics on H. C. of L.

According to reports received by the Bureau of Labor Statistics of the United States Department of Labor from retail dealers in fifty cities, the average family expenditure for food was 2 per cent higher on Jan. 15, 1920, than on Dec. 15, 1919. The cost in December was 2.6 per cent higher than it had been in any previous month. These figures show an increase of 9 per cent since January, 1919, and an increase of 104 per cent since January, 1913. The comparisons are based on the average retail prices of the following articles, weighted according to the consumption of the average family: Sirloin steak, round steak, rib roast, chuck roast, plate beef, pork chops, bacon, ham, lard, hens, flour, corn meal, eggs, butter, milk, bread, potatoes, sugar, cheese, rice, coffee and tea.

Symposium on Railway Substations

Four Papers Read at the Meeting of the American Institute of Electrical Engineers in Pittsburgh Summarize the Status of Converter Protection, Automatic Control and Related Developments

A FEATURE of the 385th meeting at the American Institute of Electrical Engineers, held in Pittsburgh, Pa., on March 12, was a group of papers by substation design experts on subjects which are uppermost in the minds of electrical engineers today. Abstracts of these are given below, and a summary of the discussion following will be printed in a later issue of this paper.

Short-Circuit Protection for Direct Current Substations*

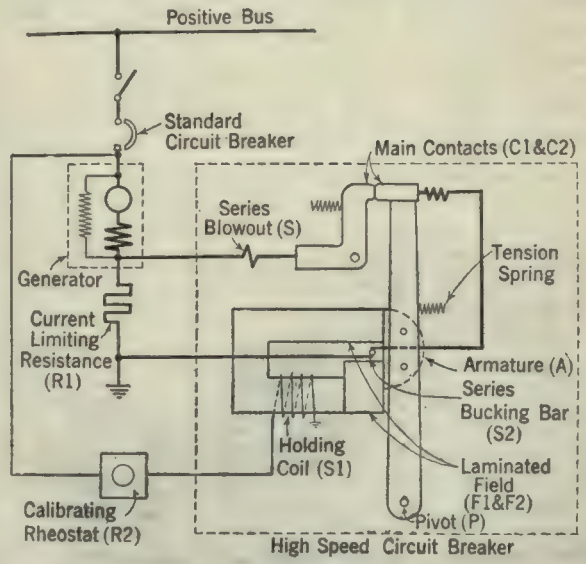
A Résumé of Development of Flash Barriers and High-Speed Circuit Breakers With Special Reference to the St. Paul Electrification

BY J. J. LINEBAUGH
Engineer Railway & Traction Engineering Department, General Electric Company, Schenectady, N. Y.

THE investigation of means to prevent flashing of direct current machinery and the development of suitable equipment have been continued since the presentation of the paper on "Protection from Flashing for Direct-Current Apparatus" by J. L. Burnham and the writer, read at the Atlantic City convention of the Institute in 1918.†

The study covered in that paper indicated that a special form of flash barrier without coolers and a new form of high-speed circuit breaker with current limiting resistance had proved the most promising development, and that tests showed that the two types of protection provided complete protection from a "dead" short circuit caused by short circuiting the terminals of a machine without external resistance. These two types of protection have been further perfected and are now in regular commercial use. They are used either separately or together, and in many instances are considered standard railway practice.

Thirteen of the improved breakers were installed by the Chicago, Milwaukee & St. Paul Railroad, as part of the electrification of its Pacific Coast and Cascade Mountain divisions.

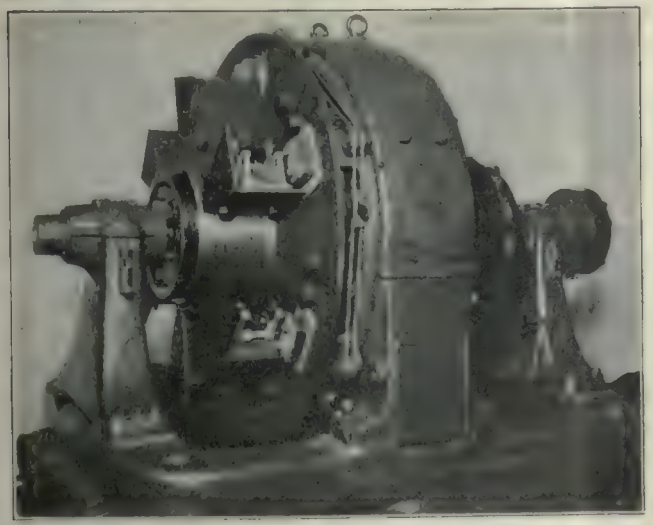


CIRCUIT DIAGRAM FOR CONNECTIONS OF HIGH SPEED CIRCUIT BREAKER

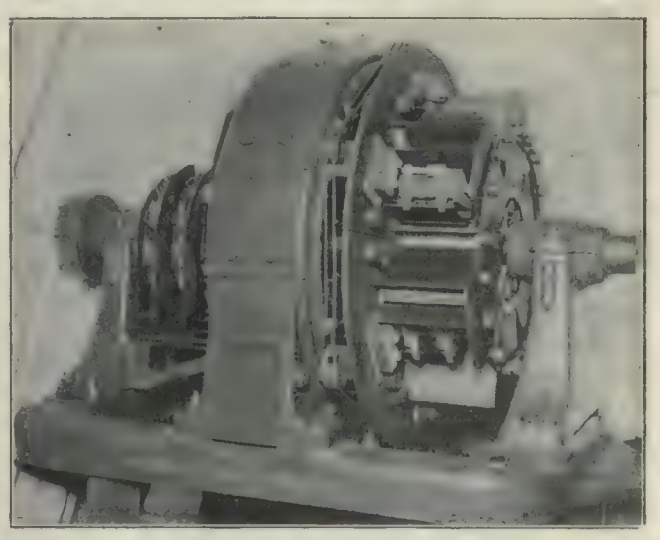
This breaker was used instead of the first type of circuit breaker, which has given successful operation during the past three years in the fourteen substations of the 440-mile original electrification of this road. The new breaker has the advantages of lower cost and

*Abstract of paper read at Pittsburgh meeting of the A.I.E.E., March 12, 1920.

†See issue of ELECTRIC RAILWAY JOURNAL for July 6, 1918, page 9.



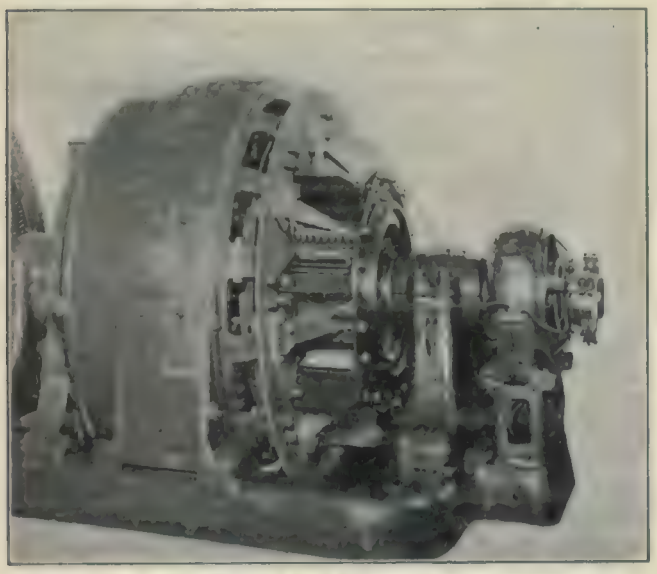
FLASH BARRIERS APPLIED TO SYNCHRONOUS CONVERTER



CONVERTER EQUIPPED WITH LATEST TYPE OF BRUSH HOLDER PROTECTION

greater simplicity. One of these breakers is used with each of the 2,000-kw. 3,000-volt synchronous motor-generator sets in the Tacoma, Renton, Cathedral Falls, Hyak, and Cle Elum substations, and the remaining five breakers are placed one each on the new gearless passenger locomotives. On account of the lower cost of these breakers and the advantages of using the "unit" system throughout, each of the sets is protected by its own high-speed breaker instead of one breaker per substation, the arrangement in the original installation. The general connections, location of circuit breakers, etc., are shown in an accompanying diagram.‡ The circuit breakers for the substations and locomotives are exactly alike, with the exception of interlocking and calibration for tripping points.

The circuit breakers were given a very exhaustive test in connection with one of the 2,000-kw. sets before shipment. It was found that the generators could be short-circuited with only sufficient cable in circuit to connect the different meter shunts, short-circuiting contactors and high-speed breaker, without damaging



GENERATOR OF ST. PAUL MOTOR GENERATOR SET EQUIPPED WITH FLASH BARRIERS

the machine in any way and with practically no flashing at the brushes.

A special reliability or endurance test was made as part of the acceptance test of the breakers, during which about sixty-five short circuits of different magnitudes, fifteen of which were "dead" short circuits, were applied at intervals of about two and a half minutes without cleaning the commutators or giving them any attention whatever. At the conclusion of these tests, five "dead" short circuits were thrown on the sets within ten minutes. At the end of these tests the commutators were in excellent condition without need of cleaning or attention of any kind.

The application of the high-speed circuit breaker to direct-current electric locomotives is another distinctive advance, as, in addition to protecting the apparatus on the locomotive, it prevents the short circuits from affecting the substations.

An incidental advantage of this type of protection is the elimination of disturbances on the alternating-

‡This circuit breaker was described in the issue of the ELECTRIC RAILWAY JOURNAL for Feb. 21, 1920, p. 394.

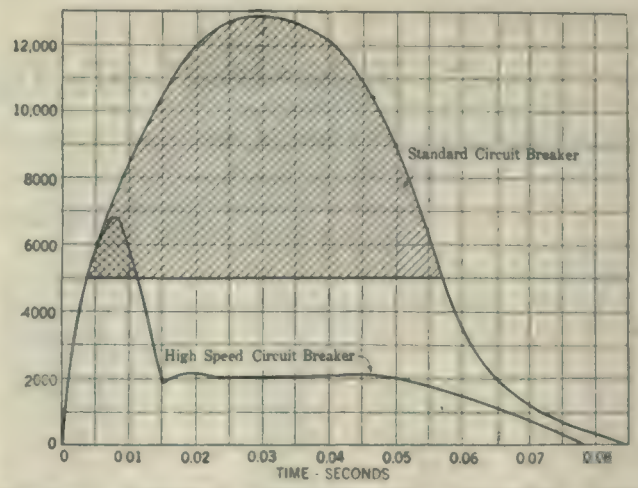


DIAGRAM SHOWING SHORT-CIRCUIT CURRENTS WITH STANDARD AND HIGH-SPEED TYPES OF CIRCUIT BREAKER

current side of synchronous converters or motor-generators sets ordinarily caused by direct-current short circuits, due to the fact that the load is decreased so quickly that momentum of the armatures supplies the energy and the load is not increased materially on the alternating-current side. The overload relays are therefore not affected, increasing very greatly the general operating efficiency of the substation, eliminating time required to start up a set from the alternating current side, etc. After the occurrence of a short circuit it is only necessary for the operator to close the high-speed circuit breakers and then the main switchboard breaker which is interlocked with the high-speed breaker, after which the main switch is thrown in following regular switching practice. If the short circuit still persists, the high-speed breaker will again open, but with no flashing or damage to brushes or commutators, and greatly increased duty on the regular breaker.

The flash barriers described in the original paper have not been changed in any essential details, improvements being along the line of simpler construction, ease of removal for inspection and improvement in appearance. An accompanying photograph shows the barriers as used on the generator of the Milwaukee electrification motor-generator sets, while another illustration shows barriers on a 600-1,200 volt, 60-cycle, 500-kw. synchronous converter.

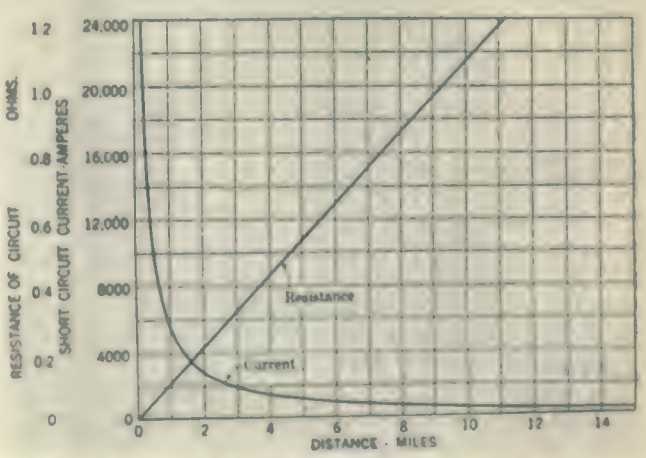


DIAGRAM SHOWING PROTECTION AFFORDED BY REMOTE TAP CONNECTIONS

Another advance in short-circuit protection is the protected type of brush holder in which the brush rigging is protected on all sides where flashing might occur, by asbestos lumber, so that an arc cannot readily hold between brush holders of opposite polarity. This protection is shown in a third photograph. It prevents the formation of iron or copper vapor, which might cause a flash to the frame and damage to the brush rigging or commutator. A removable cover is provided for inspection and removal of brushes. It is made of an iron sheet for convenience, as there is no tendency for the arc to strike this part of the brush rigging during tests or in actual operation. This type of brush rigging has been standardized for all 600-volt, 60-cycle, synchronous converters.

The use of the high-reluctance commutating poles is a very promising improvement which has just been made in 60-cycle, 600-volt synchronous converters, and has been standardized for all 60-cycle machines. This raises the flashing point at least 50 per cent.

In conclusion attention should be called to the great protection afforded by tapping the feeder at some distance from the substation. This is undoubtedly the cheapest type of protection which can be used, but cannot be relied upon to prevent flashing over under extreme short circuits. Under ordinary conditions the distance to the first tap need not be greater than 2,000 ft. A greater distance than this causes an appreciable loss of energy and drop in voltage. An accompanying diagram shows very clearly the great benefit of a small amount of resistance in reducing the maximum possible current on a short circuit.

If complete immunity is desired from short circuits, the high-speed circuit breaker and barriers offer undoubtedly the best known solution. With this protection feeder taps can be connected to the overhead trolley directly at the substation, reducing losses to a minimum. Maintenance of the substation apparatus will also be decreased, as burning from short-circuits undoubtedly causes most of the wear and deterioration on brushes and commutator. Another particular advantage of this type of protection is that it can be applied to old generators or synchronous converters of any voltage without changing the machine itself.

Flashing of 60-Cycle Rotary Converters*

The Author Analyzes the Causes of Flashing, Describes Experiments With a Number of Anti-Flashing Devices and Suggests Some Remedies for This Evil

BY M. W. SMITH
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THE protection of the 60-cycle converter from flashing is more difficult than that of commutating machines of any other class due to the inherent limitations of distance between neutral points on the commutator. This distance is fixed by the frequency and by the peripheral speed of the commutator.

The rate of increase of the direct current on short circuit is very rapid as compared with that in direct-current generators. Tests made of the generators of the 2,000-kw. sets for the Chicago, Milwaukee & St. Paul Railroad showed the initial rate of increase in current on short circuit to be approximately 1,100,000 amp. per second. On the 500-kw. converter, however, the average initial rate was approximately 3,300,000 amp. This rapid rate of increase in short-circuit current, together with the limited distance between brush-holder arms, makes the 60-cycle converter particularly susceptible to flashing trouble.

Flashing does not appear to be entirely dependent upon the value at which the current is arrested. When a machine is on short circuit a large percentage of the voltage is consumed internally. The heavier the short circuit, the larger is the percentage of the voltage thus consumed. Then so long as the direct current breaker is closed the voltage between brush arms, and hence the tendency to flash, is a minimum. The voltage between neutral points on extreme overload and short circuit with the direct-current breaker closed, is also dependent somewhat upon the brush pressure. Assuming a reasonable brush pressure and contact drop, it is practically impossible for a machine to "buck over" and hang on between arms on dead short circuit so long as the direct-current breaker is closed, for the voltage on the commutator is practically "killed." It is usually the opening of the direct-current breaker that does the damage.

FLASHING DEPENDS UPON SEVERAL FACTORS

An ideal circuit breaker is not necessarily one which opens the circuit before the machine "bucks over" (for it usually does not "buck over" until the breaker opens) or before the current reaches a certain value, but one which opens the circuit before sufficient gas and volatile matter have been formed over the commutator to cause the machine to "buck over" when the voltage is restored by the opening of the breaker. It may be said that flashing is roughly a function of the voltage, the distance between neutral points and the amount of gas or volatile matter over the commutator.

It is the writer's opinion, in view of results of very extensive tests, that a moderately high-speed breaker is no better than an ordinary slow-speed breaker. A very slow-speed breaker may even be better than a moderately high-speed breaker, due to the fact that the voltage will have time to die down appreciably before the breaker opens, especially if the alternating-current supply is opened in the meantime.

Opening the alternating current breaker is of course undesirable, because the machine has to be synchronized again. However, this procedure minimizes the flashing considerably.

The relative strength of armature and commutating-pole fields has a considerable influence upon the commutation, and hence upon the flashing of a synchronous converter on sudden changes of load and extreme overload or short circuit. Under normal load conditions the alternating-current magnetomotive force opposes that produced by the direct current. In the inter-polar space the resultant armature action is only about 15 per cent of the direct-current armature reaction and is in the same direction. The commutating-pole field ampere-turns under this condition are just sufficient to buck down this resultant magnetomotive force, and in addition to force sufficient flux across the commutating-pole gap to generate the required counter-voltage for commutation. At the instant of short circuit the con-

*Abstract of paper read at Pittsburgh meeting of the A.I.E.E., March 12, 1920.

verter acts largely as a direct-current generator, delivering the first rush of current from its own inertia, with the result that the machine is enormously undercompensated. The larger the proportion of the ampere-turns expended in the commutating-pole air gap, or its equivalent, the less will be the effect of the armature reaction upon the commutating-pole flux and hence upon the commutation and flashing of the machine.

Sudden changes in the frequency applied to the converter are equivalent to the machine being out of phase and produce similar results from the standpoint of flashing. In one case where flashing occurred with a 1,000-kw., 600-volt, 25-cycle converter, the trouble was eliminated by greatly increasing the strength of the commutating-pole flux.

Difficulties in Applying the Flash Suppressor to Rotaries

The flash suppressor, as applied to converters, is simply a high-speed switch actuated by the short-circuit current, much in the same manner as a circuit breaker, which short-circuits either all or a part of the collector rings.[1] This reduces or "kills" the voltage on the commutator to such an extent that it prevents the machine from flashing over. This device has already been applied to generators of the motor-generator sets in the substations of the Chicago, Milwaukee & St. Paul Railroad.

In connection with the rotary converter the operation of the flash suppressor means practically a short-circuit on the alternating-current system through the converter transformers. In addition the machine has a tendency to fall out of step, requiring it to be resynchronized if it does so. Tests were made with inductance in the local suppressor circuit for the purpose of finding out the maximum value of inductance which could be used to limit the alternating current and still reduce the direct current voltage sufficiently to give protection on the direct-current side. It was found that in order to give such protection the value of this inductance has to be such that upon the opening of the direct-current breakers the direct-current voltage would not rise above the value it had dropped to due to the direct-current short circuit. The test showed that reasonable protection could be had at about eight times full direct current load without drawing over nine times full load alternating current.

With the idea of preventing the machine from dropping out of step, a three-pole oil circuit breaker was put in the local leads of the suppressor circuit in connection with the above test, so as to open this circuit and throw the machine back on the line. It was found that this could be done without any particular disturbance up to the point where the inductance in the suppressor circuit had to be decreased (for protection to the direct-current side) sufficiently to cause the machine to fall out of step. This was approximately ten times full load.

The tests showed clearly that the flash suppressor will give ample protection from flashing to the converter as far as the alternating-current side is concerned. However, there are several problems connected with the application of the device to synchronous converters, such as the increased duty on the collector rings, disturbance to the alternating-current supply system and the falling of the machine out of step, which have not as yet been worked out.

Various forms of flash guards have so far proved to be unsuccessful. These consisted of two continuous end rings, one at the back of the commutator and one at the front with barriers between arms extending down to within approximately $\frac{1}{32}$ in. of the commutator. All tests indicated that these barriers should be of an open construction and as far away from the source of the arc as possible so as to give it sufficient room to expand and dissipate itself without becoming explosive. In other words, the barriers should be next to the parts to be protected (as the pedestal and leading side of brush holders) and as far away from the arc as possible. Best results have been obtained by protecting the pedestal with an arc shield and leaving as much space as possible on the commutator for the arc to expand. This also gives free access to the commutator, the lack of which is one great disadvantage in any form of flash guards.

[1] For a description of this device, see ELECTRIC RAILWAY JOURNAL, May 4, 1918, pages 853 and 891.

Automatic Railway Substations*

An Account of Some of the Improvements Made During the Past Five Years and an Outline of the Present Status of Automatic Control

BY FRANK W. PETERS
Railway & Traction Engineering Department, General Electric Company, Schenectady, N. Y.

The use of automatic substations, as shown by several years of use, has resulted in decided economies and improved operating conditions, and as the subject has not been presented before the Institute since the account of the original installation† was prepared, a review of the modern automatic equipment seems desirable.

The individual devices comprising the first equipment were, with but few exceptions, those which had previously been developed by electrical manufacturers for use in other applications. This condition was a decided advantage to the operating companies since development charges were eliminated, rendering the equipment comparatively low in cost. This in addition to the successful operation of the early installations, made possible the rapid growth of automatic application to electric railways.

Automatics Are Used in Considerable Variety

Shortly after the initial installation on the Elgin & Belvedere Electric Railway, the two remaining substations on that road were made automatic, followed by the Potomac Electric Power Company which made automatic a 500-kw. substation. About that time (1916) the Des Moines City Railway and Inter Urban Railway, two adjacent roads, outlined the now practically completed program involving automatic substations. These roads now have in operation a total of three 300-kw. and nine 500-kw., 600-volt automatic synchronous converter equipments. The confidence inspired in the minds of operating engineers and the rapid adoption of this comparatively new phase of electric railway operation was in no small measure accelerated by the successful performance of this rather broad application.

The range of requirement to which the new scheme

*Abstract of a paper read at the Pittsburgh meeting of the A.I.E.E., March 12, 1920.
†See ELECTRIC RAILWAY JOURNAL for Sept. 18, 1915, page 583.

could be successfully applied was demonstrated when in 1917 two 300-kw., 600-volt, 60-cycle synchronous converters operated in series on 1,200 volts by the Milwaukee Railway & Light Company were automatically equipped. Two automatic substations each containing one 600-kw., 1,500-volt d-c. induction motor-generator set were also installed in 1919 by the Salt Lake, Garfield & Western Railway. The Rhode Island Company has for some time been operating a station containing two 300-kw., 600-volt converters in parallel, while in other localities portable automatic substations have been functioning successfully. Railway converters now automatically equipped range in size from 200 to 1,500 kw. with motor-generator sets from 300 to 2,000 kw. The total capacity operating in this manner and including those in process of installation is estimated to be 32,000 kw. while the number of automatic equipments involved is approximately seventy-five, fifty of which having been applied to 300 and 500-kw. sizes, and the remainder cover the range of various types and sizes of installations briefly referred to.

Without question a direct reduction in operating expense has been the prime motive for the purchase by railway companies of automatic substations. The saving is effected in several ways, although it is variable and depends upon conditions under which a particular station is operated, as well as the number and capacity of machines in the station. The following are the principal items of saving: Labor, light-load losses, fuel for heating, building construction, saving resulting from improved load factor, feeder costs and reduction of electrolysis losses.

What Automatic Control Actually Does

Under automatic control the functions of starting and connecting the machines to the line upon power demand and finally shutting them down after the demand for power has ceased are all carried on in their proper sequence without any assistance whatsoever from an operator. In present day practice the great majority of these stations are controlled entirely by the automatic equipment, but a few are, for specific reasons, remotely controlled by dispatchers with the aid of a pilot wire. A remote-control station may be considered in the same class with a purely automatic station since the control current merely replaces the automatic devices which determine when the station is to start or stop. The remaining apparatus which performs the actual switching operations is identical in both cases.

Protective devices having the following duties are provided to perform the functions ordinarily left to the discretion of the operator: (1) To limit the overloads. (2) To limit the temperatures. (3) To shut down the machine when a.-c. or continuous d.-c. short circuits occur, upon failure of alternating current, upon failure of any device, in case of excessive speed and upon reversal of direct current. (4) To prevent machine starting during low a.-c. voltage and during single-phase a.-c. supply periods.

In stations containing a motor-generator set, instead of a synchronous converter, certain modifications of the equipment are necessary to accommodate the starting operations, but the scheme of operation with few exceptions is similar to the converter equipments. Oil-immersed starting and running contactors are used because of the higher transformer secondary voltage and a certain amount of overload protection is obtained by inserting one or two steps of resistance in the generator field circuit in addition to two steps of series resistance in the main d.-c. circuit. This arrangement reduces initial cost since the field resistance and its contactors are of small capacity. An energy saving in resistor heat loss is also accomplished. The 250-volt generator on the drum controller becomes unnecessary in the case of a motor-generator automatic equipment.

Improvements that Have Increased Reliability

The recent development in automatic equipments has largely consisted of perfecting and making more reliable the present type of station as well as arranging for and applying the principle in other applications such as lighting, mining and hydraulic generating stations. Among specific instances of improved design may be mentioned the elimination from the equipment of all disk-type interlocks and the substitution of substantial finger-type auxiliary contacts. Relay contacts element have been improved where necessary so as to provide a quick make-and-break action and on direct-current circuits blow-out coils have been added. An improved type of motor-operating mechanism for oil circuit breakers is now in use in which compactness and reliability are the outstanding features. Direct-current contactors having a rupturing capacity sufficient to handle any load conditions have been developed and are performing their function with complete success. Reverse current and under-load relays of substantial construction and capable of accurate calibration at low current values have been designed to accommodate the conditions of automatic substation operation.

The use of automatic control in railway substations has in a comparatively short time expanded to where it is firmly established in city and interurban railway operation. The successful experience of the past has resulted in larger capacity stations serving heavy traffic being made automatic. The adaptation of this type of control to electric trunk line service at 2,400 or 3,000 volts direct current as well as more extended use in the strictly industrial field is not far beyond the horizon.

Automatic Substations for Heavy City Service*

The New Method of Control Simplifies Distribution Problems and, Judicially Used, Saves Money and Improves Operating Conditions

By R. J. Wensley
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

IT IS very gratifying to those directly interested in the automatic substation that the larger city street railway systems are eagerly taking up the question of rebuilding their distribution systems by taking advantage of the savings made possible by automatic operation of converting equipment.

The earlier street railway systems made little or no attempt to lay out the distribution lines with economy or efficiency. Any location available was seized on as a power-house site. Cables were run the shortest possible distance to the trolley wire and from that point the trolley wire was usually the only means of carrying current. As service demands increased the voltage

*Abstract of paper read at Pittsburgh meeting of the A.I.E.E., March 12, 1920.

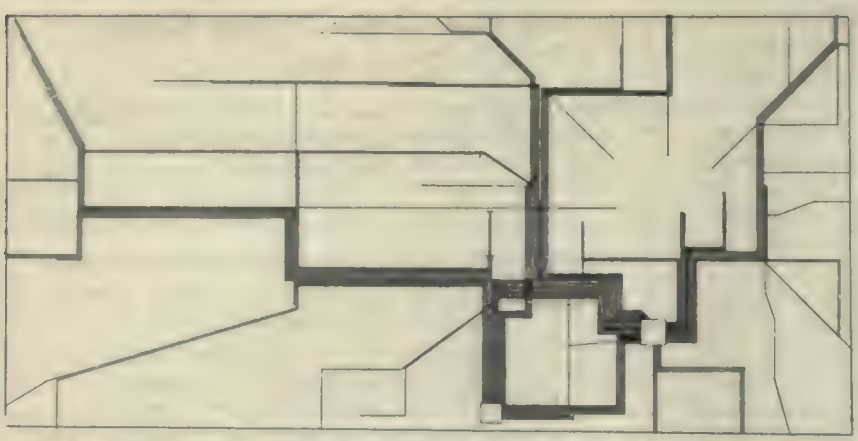


FIG. 1. FEEDER COPPER NOW IN USE IN CITY OF 300,000 POPULATION

drop became too great for satisfactory service, and to remedy this the voltage was increased and feeders were run parallel with the trolley.

As the demands still further increased, the factor of electrolytic destruction of underground pipe necessitated the use of heavy copper feeders in parallel with the rail. The negative booster was also freely used to compensate for the drop in these return feeders.

When first the engine-driven alternator and later the turbo alternator came to the front as the most economical means of power generation, the railway substation soon became popular. In some of the larger cities there were installed one or more central steam plants with a number of large substations located in various parts of the city. Owing to the cost of operating labor, the number of these was kept down to the minimum even at the expense of considerable investment in feeder copper. Not only were large amounts of feeder copper thus involved, but transmission losses were high and schedules were slow.

The development of automatically controlled substation equipment has placed in the hands of the distribution engineer a possible method of reconstruction that is little short of ideal. Substations can now be scattered about without the specter of heavy and ever-rising operating labor expense. The increase in the number of substations enables the holding of good trolley voltage without heavy expense in large feeder capacity. Trouble due to electrolysis is largely minimized and in many cases entirely eliminated by the increase in number of substations.

Care must be used in applying this remedy that it is not overdone. Sizes of machines and stations must be carefully calculated so that the load factor will be high. In deciding on the best sizes for equipment, several factors must be considered. Interchangeability is always desirable and, therefore, there should be as few different sizes of machines as is consistent with economical operation. In most city applications two machines will prove to be best, with space provided for a third to take care of future growth.

Where two machines are selected for a given location each one must be capable of carrying the normal off-peak load without assistance. The combined capacity must be sufficient to take care of the peak load.

TABLE I—DATA USED IN CALCULATIONS

Population of city	300,000
Present direct-current capacity, old plant (lower), kilowatts	8,000
Rotaries in new plant (upper)	3-2,000 kw.
Total area of positive and negative feeders, leaving old plant, circ. mil	25,800,000
Total area of feeders leaving new plant, circ. mil	23,000,000
Total area of tie lines, circ. mil	8,000,000
Total area in positive feeders, circ. mil	40,000,000
Total area in negative feeders, circ. mil	16,800,000
Average length of feeders to center of load, miles	2
Peak load on two plants, amperes	22,000
Average I^2R loss at peak load, kilowatts	2,750
Number of cars operated in heavy traffic	300
Average weight of cars, tons	20
Motor equipment of cars	2-60-hp.
Schedule speed in rush hour, miles per hour	6
Balancing speed of cars, miles per hour	27

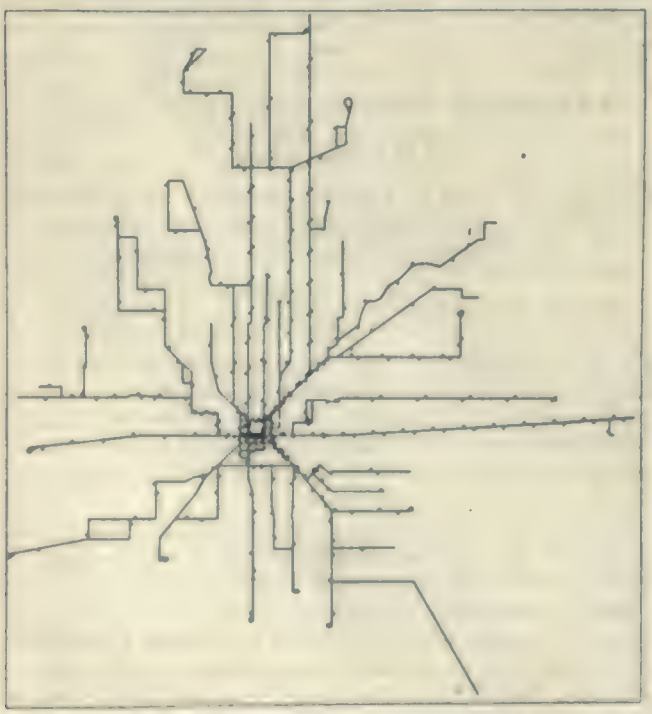


FIG. 2. SPOT MAP SHOWING REQUIREMENTS FOR CARS IN CITY OF 300,000 POPULATION

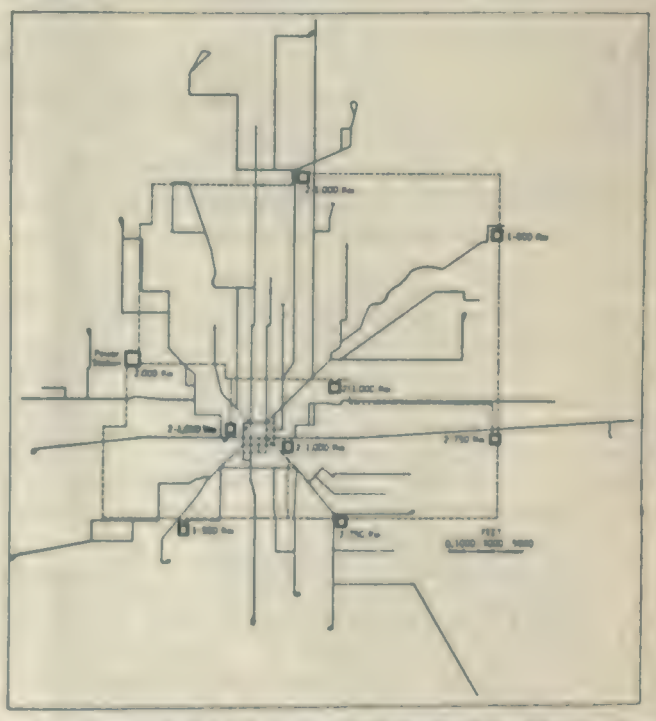


FIG. 3. SUGGESTED LAYOUT OF POWER SYSTEM WITH AUTOMATIC SUBSTATIONS FOR THIS CITY

TABLE II—BALANCE SHEET FOR PROPOSED SYSTEM

Gross cost of the new system:	
11,500 kw. of substations at $40	$460,000
25 miles of line at $5,000	125,000
Reconstruction of feeder system	25,000
Power house equipment, transformers, etc	100,000
Total cost of automatic substations	$710,000
Credit power plant scrap	100,000
Credit copper removed	205,380
Net cost of automatic substations	$404,620
Fixed charges at 15 per cent	$75,693
Annual operating labor	7,000
Gross annual charges against automatics	$82,693
Savings due to the new equipment:	
Annual saving in copper loss	$66,000
Annual saving in platform labor	14,600
Annual saving in labor due to shutting down of old power plant	50,000
	$130,600
An ual cost of substations	$82,693
Net operating credit annually	$47,907

By selecting machines of combined continuous capacity equal to the root-mean-square value of the peak load, a reasonable reserve capacity is allowed since the two-hour rating will probably allow one machine to pull over the peak if the other is out of service. To help in such cases, a limited number of feeders should be run through from one station to another, so that a feeder may be opened in the station in trouble, thus transferring a portion of its load to an adjacent station.

HERE IS HOW THE AUTOMATIC PLAN WORKS OUT

To illustrate the way in which the problem of applying automatic substations to city service should be approached, a city of about 300,000 population has been selected as an example. This represents good practice under the old method of centralized distribution. Fig. 1 shows in a general way the distribution of the feeder copper, details of which are given in table I. The two plants used here are about ¾ mile apart on the same side of the city, and about one mile from the loop district where occurs the section of the greatest load concentration.

The problem is to lay out a new distribution system which will reduce the transmission losses to a minimum, raise the average trolley voltage to a reasonable value, keep the stray earth currents at a minimum and at the same time avoid raising the expense for operating labor to an undue amount. All of this must be accomplished at the lowest possible net cost.

Preliminary to deciding on the size and location of substation equipment, a spot map of the system, based on rush-hour schedule, is desirable. A sample is shown in Fig. 2. A disturbing factor in this case is that there are fourteen interurban lines entering the city, all of which operate fairly heavy cars. In laying out the power supply it has been assumed that two of these cars are at the center of each line which they use for entering the city and that one is equivalent to two city cars. The average current per city car has been taken as 53 amp. After consideration of all of the factors entering into this case, the final location decided upon for the substations was as shown in Fig. 3. Table II shows the balance sheet for this change with the saving which the proposed plan would yield.

In this solution of the problem the entire equipment should be automatic in operation, except the one converter retained in the power plant. One of the converters in one of the loop stations would be set for continuous operation. Many modifications of this layout are possible without materially altering the saving shown.

Is the Use of the Screw Spike Justified?

Baltimore Company Abandons Its Use—Result of Questionnaire Addressed to Prominent Roads Given

BY W. W. WYSOR

Chief Engineer United Railways & Electric Company, Baltimore

IN THESE critical days of the street railway industry, when operating officials are seeking to learn how they may economize in every way possible, it is well not only to point out economies that may be effected, but also extravagances that may be avoided. In caring for the physical properties of the industry, and in building extensions or additions we should consider how the work may be done at the least cost consistent with good construction. It is important that the work be done properly—better one job done right than two jobs done halfway—but there is such a thing as needless refinement and unnecessary expenditure. Our watchword should be "efficiency," and this applies not alone to the men employed in doing the work but to the methods and materials selected for doing it. If a bridge is to be built over which 10-ton cars are to be operated, it is manifestly a waste of money to build a bridge strong enough to carry 300-ton locomotives; if ⅜-in. trolley cord is sufficient, it is obviously foolish to use 1-in. rope merely because it is stronger; if we wish to move an article weighing one hundred pounds from one section of the city to another, we do not employ a five-ton truck. This brings us down to the question, "Why is a screw spike?"

For a number of years past, in the city of Baltimore, screw spikes have been used as standard construction on all girder rail, with the exception of special work, but there does not seem to be any logical reason for having done so nor for continuing this practice. When the question was asked: "Why use screw spikes?" the answer generally was "Because they hold better," or the more indefinite one, "Because it is better practice or in line with more up-to-date methods." There is no doubt that screw spikes, when newly driven, require more force to withdraw them than do nail spikes, but when ties decay or spikes for any reason become loose, the greater holding power of the screw spike is lost. Moreover, if the lifting force exerted on nail spikes is not sufficient to withdraw or loosen them, why go to the expense of providing a spike of greater holding power? The functions of a spike are to hold the rail to gage and prevent overturning, and there is every evidence, so far as the observations of the writer go, that this is performed by the nail spike equally as well as by the screw spike, at least in street railway tracks.

In the last few years we have reconstructed in the city of Baltimore many miles of track which had been down for periods ranging from ten to twenty-five years and which had been laid with nail spikes. In every case where ties were solid, the spikes were found in place as originally driven, and it required as much or more force to withdraw them than it did newly driven spikes. In the case of rotten ties, of course any form of spike is valueless.

About two years ago we started keeping a record of the cost of screw spikes as compared with nail spikes and found that the former cost about $1,500 per mile more than the latter, without any apparent benefit.

In order to determine what the various roads were

doing, a questionnaire was prepared and forwarded to forty-eight of the most prominent street railways in the country. Replies were received from thirty-six companies—a list of the questions and a resumé of the answers received being shown in the following statement. It will be noted that a majority of the companies do not use screw spikes and most of the companies that do employ them use them only in particular cases, such as for bridge and subway work. For this kind of work, where traffic is very heavy and where the rails wear out long before it is necessary to renew the ties, the use of screw spikes may be justified, inasmuch as they can be withdrawn and redriven with less damage to the ties; but for ordinary construction in paved streets, not a single valid reason has been given for their use.

When screw spikes were first adopted on this property, tie plates were adopted at the same time, and it seems probable that this was true of other properties, not only of street railways but steam roads, and the better results that have been obtained from this type of construction were, in my opinion, due entirely to the tie plate and not to the screw spike. After a very careful consideration of the matter, this company has abandoned the use of screw spikes but has retained the tie plate. We believe the tie plate to be well worth its cost.

While this article deals with the use of screw spikes in connection with street railways only, it is well to call attention to the report of the committee of the Pennsylvania Railroad, dated April 27, and published in October, 1917, in the Bulletin of the American Railway Engineering Association. This report covers the experimental use of screw spikes ranging over a period of nine years, and the conclusion reached by the committee was that screw spikes have no advantage over nail spikes.

Results of Questionnaire on Screw Spikes

Question No. 1—Do you use screw spikes? Answers: Four companies answered "yes"; ten companies, "to a limited extent only"; twenty-two companies, "no".

Question No. 2—Are they employed as standard construction in (1) city streets? (2) on interurban T-rail track? (3) on special construction such as subways, elevated structures, etc? Answers: (1) Four companies answered "yes"; nine companies, "no". (2) Fourteen companies answered "no". (3) Eleven companies answered "yes" and three "no".

Question No. 3—On what sections of rail are they used? Answers: Eight companies answered "standard T-rail"; six, "high T-rail (Shanghai)"; seven companies, "girder rail."

Question No. 4—Do you use tie plates with screw spikes? If so, are they specially formed so as to give support to the head of the spikes? If not, do you use a clip? Answers: Five companies replied they did not use tie plates; three companies that they used plain plates; three that they used special plates and three that they used combination plates and clips.

Question No. 5—What considerations led you to adopt the screw spike? Answers: Three companies replied "increased holding power"; four, "special construction, such as subways and bridges and where more or less permanent foundation is employed and where rails can be renewed without disturbing the foundation"; two, "experimental only"; one, "best type of fastening"; one, "used with tie plates to prevent cutting of ties"; one, "on account of decreased maintenance of special work"; one, "seemed to be in accordance with best practice".

Question No. 6—Has it met with your expectations and proved satisfactory in service? Answers: Three replied "yes"; one, "no"; three, "experimental only"; seven, "yes for special purposes for which they are applied".

Question No. 7—In comparing the performance of screw spikes as against nail spikes, are tie plates employed in both cases? Answers: Seven companies replied "yes"; seven, "no"; four, "no comparisons made".

Question No. 8—What is the excess cost per mile of single track of screw spike construction over nail spike construction? Answers: Ten replied "no data"; one, "double the cost of hook-headed spikes"; one, "$2,422.00"; one, "$1,000.00".

Question No. 9—Do you consider screw-spike construction of sufficient superiority to justify this excess cost? Answers: Four companies said "yes"; five, "no"; three, "yes as limited to special construction"; one, "in hard wood, no; in soft wood, yes".

Comparison of Automobile and Electric Car Passengers in Schenectady

THE officials of the Schenectady Railway Company, Schenectady, N. Y., have compiled some figures giving a comparison of the trolley and pleasure car traffic in that section during the years 1912 to 1918 inclusive. During this period there has been a constant increase in the number of automobiles used so that the ratio of trolley car passengers to pleasure car passengers has decreased from 20 to 1 to 5 to 1. During the year 1918 there were slightly over 4,000 pleasure cars in that city, or one car for every twenty-six people.

The records of automoblie registration in the office of the Secretary of State for the year 1919 are not yet available, so a comparison for this year is not included. However, the registrations of automobiles were about 30 to 35 per cent greater in 1919 than in 1918, according to a statement made by Secretary of State Hugo during a talk in Schenectady in October, 1919. Just how this increase is distributed in Schenectady and over the State in general would be hard to estimate.

The accompanying tables give detailed figures and comparisons, which will be of interest.

RATIO OF TROLLEY CAR PASSENGERS TO PLEASURE CAR PASSENGERS IN SCHENECTADY

Year	Trolley Passengers	Pleasure Car Passengers
1912	20 0	1
1913	18 8	1
1914	12 8	1
1915	9 4	1
1916	7 7	1
1917	6 2	1
1918	5 08	1

PLEASURE CARS IN SCHENECTADY, 1912-1918

Year	Number Riding Per Day	Total Riding 214 Days	Pleasure Cars in the City	City Population Per Car
1912	4,330	926,620	866	98
1913	5,510	1,179,140	1,102	86
1914	7,425	1,588,950	1,485	65
1915	9,180	1,964,520	1,836	49
1916	12,755	2,729,570	2,551	39
1917	16,920	3,620,880	3,384	32
1918	20,035	4,287,490	4,077	26

Note—Allowing seven months (April - October, inclusive) or 214 days riding period per car, five passengers per car.

DATA REGARDING TROLLEY CAR SERVICE IN SCHENECTADY, 1912-1918

Year	Revenue	Passengers Carried (City) Transfer	Free	Total	Number Cars	Passengers per Car	Population per Car	Rides Per Capita Per Year
1912	$15,659,267	2,515,148	479,597	18,654,102	151	123,536	562	220
1913	17,446,810	3,025,274	563,903	21,135,987	158	133,765	899	226
1914	16,482,476	2,919,520	578,034	19,980,030	158	126,456	611	206
1915	14,818,223	2,577,047	524,325	17,969,645	158	113,725	569	199
1916	17,266,463	2,924,553	578,485	20,769,501	158	131,452	623	208
1917	18,725,891	3,147,185	580,985	22,454,061	174	129,046	622	207
1918	18,162,463	3,104,355	525,805	21,792,623	172	126,701	623	202

Characteristics of Rail Bonds*

A Summary of Present Practice in This Field With Comment Upon the Merits and Demerits of the Important Types of Bonds Now and Previously in Use

BY RALPH H. RICE
Principal Assistant Engineer Board of Supervising Engineers Chicago Traction

PRACTICALLY all American electric railway systems operate with grounded returns. The track is usually quite intimately in contact with the earth, which is a good conductor; hence we have the condition that the return current from the car is discharged into the conducting rails and earth with its buried pipes or other metallic structures. So long as the rails are in contact with the earth a division of current between them will always occur in accordance with the laws of divided circuits, and while we cannot entirely eliminate the leakage of current from the rails we can minimize it. Our treatment for leakage or stray currents must be either to prevent any passage of current from the rails to the earth by insulating the rails, or by making the rails such good conductors that only a negligible amount of current will leave them. The former method is not practicable and we shall inquire into the latter.

In some cases, particularly in large cities, it is feasible to make the rail practically continuous by welding the splice bars at the rail ends. While such a process is used for mechanical reasons in securing a good joint, it also serves to secure a very low resistance connection between adjacent rails. Several forms of such welds are in use and when properly made they produce an electrical connection which does not exceed in resistance that of an equal length of the rail. The earliest form of such connection was the cast weld produced by pouring molten cast iron into a mold around the rail ends. It was a rather satisfactory mechanical joint but was not of much certain value electrically and has practically been superseded by more efficient forms. A more modern form is the thermit weld. In this the rail ends are actually melted down into a homogeneous mass of great strength and high conductivity. The Clark joint, a special form of this joint, has a weld made between the bases of the rail, thus securing electrical continuity, the ordinary bolted splice bars being used for the mechanical joint.

TABLE I—RESULTS OF TESTS OF ELECTRICALLY WELDED RAIL JOINTS IN CHICAGO

	Joints	Percentage
Total tested	44,263	100.00
100 per cent or more conductance	43,769	98.88
Below 100 per cent—		
No break visible	203	0.46
Broken	291	0.66
Total	494	1.12

In the electric weld heavy bars of steel are spot welded to the web of the rail by a heavy electric current. This process requires special apparatus but produces most excellent results. About 150,000 of these welds have been made on the street railway lines of Chicago and the results of tests made on some of them, covering a period of three years, are as given in Table I.

Arc welded joints are similar to the electric weld except that the electric arc is the source of heat.

Special forms of joints, such as the Clark already mentioned, and the Nichols, are used. The latter is made by pouring molten zinc around the bolted or riveted splice bars. Upon cooling, the zinc expands and, if the rail surfaces are clean, it makes a low resistance joint.

These forms of rail weld take the place of rail joint bonds and should be considered when making a selection of the form of connection to use. They are better adapted to heavy city service than any other service on account of their cost, and of the fact that the rails are protected by the pavement from rapid fluctuations in temperature under which conditions a continuous rail may be maintained better than in the open country.

WHAT IS REQUIRED OF A RAIL BOND?

When the track is not welded, some form of electrical connection between the rail ends is essential, and to meet this need various types of bonds have been developed. Bonds are subject to breakage due to mechanical defect, temperature changes, vibration and flexure. They are also subjected to corrosion at the contact surface with the rail, and to oxidation and consequent increase of contact resistance to an amount which destroys their usefulness. Bonding is largely a mechanical problem of maintaining a low resistance contact against the destructive agencies mentioned above.

In a rail bond we want (1) high conductance from rail to rail, (2) permanent contact with rail, (3) protection of bond from theft or mechanical injury, (4) ability to withstand vibration and mechanical strains incident to operation, (5) provision for ready installation by low-grade labor, (6) provision for ready installation without interruption of traffic, (7) ease of inspection and test, (8) as low a cost as is consistent with the grade of installation desired.

To see what has been done to meet these requirements we may make an analysis of types of bonds, under three headings: (A) construction of bonds, (B) location of bonds, (C) application of bonds.

This analysis is shown in Table II.

TABLE II—ANALYSIS OF BOND CHARACTERISTICS

A—Construction:
1. Terminal—see Application of Bonds.
2. Conductor
   Solid
   Stranded
   Ribbon.

B.—Location:
1. On web of rail
   Exposed
   Concealed
2. On head of rail
3. On base of rail

C—Application:
1. Bolted connections
2. Soldered terminals
3. Plastic or amalgamated
4. Pressure terminals
   Pin terminal
   Compressed terminal
   Socket terminal
5. Brazed or welded terminals
   Arc weld
   Flame weld
   Electric weld
   Copper weld.

ELEMENTS OF BOND CONSTRUCTION

All railway bonds are of copper. Each consists of two parts, the conductor and the terminals for attachment to the rail. The terminals have many forms, which will be considered later. The con-

*Abstract of paper read at annual meeting of Central Electric Railway Association, Louisville, Ky., March 10, 1920.

ductor may be solid, stranded or of flat ribbons, depending upon the length, size and location of the bond. A solid conductor is generally used for long bonds and when not subject to vibration. The ribbon conductor is usually applied with its laminations horizontal and when the bond is subject to vertical motion only, as on third rail construction. The stranded conductor is most commonly used, as it is very flexible in all directions. Special stranding is used and the conductor is divided into two or more cables if necessary. The conductor is usually attached to the terminals by welding, although the terminal is sometimes cast and one type of bond has the copper strands formed into a terminal. The latest type of bond, which is not yet on the market, is one in which a copper terminal is welded to the conductor, and then a facing of steel is brazed to the terminal by the manufacturer. When this bond is applied to the rail a weld is made between the steel face and the rail. This seems to promise excellent results, but is expensive.

Probably the most frequent application of bonds is to the web of the rail, as being the location which interferes least with the track construction and in which the bond is most protected from ordinary injury. Less frequently bonds are applied to the head of the rail and, sometimes, as on an elevated railway third rail, to the base. When applied to the web the bond may be of the exposed or concealed type. The exposed type is attached to the rail beyond the ends of the splice bars and is unprotected in any way from injury or theft. The concealed type is passed under the splice bar and cannot be removed without removing the bar. In some forms the conductor and terminals are entirely under the bar. Special shapes and divisions of the conductor have to be made to enable the bond to keep clear of the bar and bolts, so that the conductor will be free to move with the movement of the rails.

The greatest variety of bond terminals has been devised with the aim of securing a mode of attachment to the rails which will be easy to install and will result in a permanent and efficient electrical connection. Some of the types mentioned below are now practically obsolete, for the reasons given, and others have merits which will be pointed out.

The ideal to be aimed at in any installation of joint bonds is to make a connection between the rails that will not increase the track resistance above that of the continuous rail. In commercial practice a terminal contact area of perhaps seven to nine times that of the cross-section of the bond conductor is customary, which is approximately two-thirds of the theoretically required area.

Bolted Connections: Bolted connections have not been successful. It is difficult to bring into intimate contact large flat surfaces unless these have been carefully prepared for such purpose. The bulk and cost of such connections, and the practical impossibility of maintaining tight joints has eliminated this type for electrical connection. The old channel pin device by which a bond wire is held in a hole by a wedge driven between the wire and rail, is really a form of mechanical connection similar to a bolted connection, and is subject to the same general limitations. Some recent work has been done on developing forms of bolted connections which are superior to the older types.

Soldered Bonds: Soldered bonds require no rail drilling, but do require a thorough cleaning of the rail, which is sometimes more troublesome than drilling. Such a bond should be applied above ground, as corrosion is sure to impair its value. The soldering fluid used is often the cause of corrosion, and is always a potential source of trouble. The co-efficient of expansion of copper is nearly twice that of steel, so that with temperature variations the film of solder connecting the two different metals is subjected to continual strain and under the vibrations due to traffic will ultimately fail.

With soldered bonds it is difficult to secure complete contact between the rail and the terminal surfaces, no matter how carefully the work is done. The heat capacity of the rail is also so great that it is difficult to gèt it to a soldering temperature so that frequently the edges of the bond are well attached to the rail but the inner portion is not, and the expected conductivity is materially reduced. On account of the difficulties mentioned soldered bonds have fallen into disfavor.

Plastic Bonds: Plastic or amalgamated terminal bonds have been used to some extent. In this form of bond the rail and terminal surfaces are amalgamated and amalgam is placed in some form of pocket between the rail and bond and permanently held in position by the joint plate. The integrity of the connection is dependent upon the permanence of the clamping device, and experience has shown that such dependence is usually found unjustified by the results. Amalgam may be used with any type of mechanically applied bond as an aid in securing good electrical contact, and tests show that it is effective to some extent in this manner.

Pressure Type of Bond: The pressure type of bond is that in which the copper terminal is placed in a hole drilled in the rail and then in some manner pressure is applied to force the material of the terminal to expand radially and thus come into close contact with the side or wall of the hole. With this form of terminal the continued efficiency of the bond is dependent upon the two metals remaining permanently and intimately in contact. As there is no solder, bolt or other external agency to hold them, the maintenance of the contact seems to depend upon the absence of any cause tending to separate them. It has been claimed that temperature changes due to varying weather conditions will cause the copper terminal to loosen from close contact with the steel, because the copper has a higher temperature co-efficient of expansion than steel. On the other hand, it is claimed, with apparently good reason, that when the copper terminal has been subjected to pressure the distortion of the copper hardens it and it becomes elastic. The elastic properties of the copper and steel will then allow an expansion and contraction action between them sufficient to withstand the stresses caused by ordinary temperature changes.

Pin Terminal Bond: One form of the pressure terminal is the so-called pin terminal or tubular bond in which the terminal has a hole through the center into which a steel pin is driven. These bonds have the advantage of easy application without specially skilled labor. They are quickly applied and require no special tools. In Chicago this type of bond is used on the internal joints of all special work. Over 50,000 40-in. No. 00, ¾-in. terminal bonds have been used.

Compressed Terminal Bond: Another form of the pressure type is the compressed terminal. In this form longitudinal pressure is applied to a solid terminal in such a manner as to produce radial expansion of the

terminal. The terminal is placed in a hole the same size as the terminal and then pressed between the jaws of a screw or hydraulic compressor. The application of this form of bond requires a more highly skilled class of labor than does the pin terminal, and is not so dependent upon a properly drilled hole in the rail, but requires proper centering of the compressor. Probably the chief difficulty with the application of this form of bond is to know how much compression to apply.

Socket Terminal Bonds: A third form of pressure terminal, which may be called a socket terminal, is that in which a hole is drilled into but not entirely through the rail, making a pocket into which the copper terminal is forced by hammering or other pressure. Often the hole has an enlargement of some form, such as a groove, made in its sides so that the copper will flow into this enlargement and the terminal will be held more rigidly, as well as having more area of contact with the steel. This form of terminal partakes of the characteristics of both the pin terminal and the compressed terminal. It is more like the former in its ease of application, and more like the latter in that some irregularity in drilling the hole is not so detrimental to a good contact.

Brazed or Welded Terminals: A brazed or welded attachment is made by the application of heat to the rail and terminal in sufficient amount to soften them so that by the application of pressure the two surfaces may be brought into very close contact and a permanent, low-resistance joint is secured. A connection of this kind made between two pieces of the same metal is a weld, but if a third metal, such as brass or solder is used to fill in between the two metals, then we have braze. Most of the commercial bonds of this type are brazed to the rail. According to the manner of applying the heat we have several forms of brazed or welded connections which may be classified as follows: (1) Arc weld—heat furnished by an electric arc. (2) Flame weld—heat furnished by oxy-acetylene flame. (3) Electric weld—heat furnished by current passing through carbon electrodes in contact with the bond terminal. (4) Copper weld—heat furnished by pouring molten copper into a mold surrounding the bond terminal.

All of these forms of welding require some special apparatus. Each form is sponsored by some manufacturer who contracts to do the work or furnishes the equipment required. They require care and skill in their application: The welding temperature is high and burning of the steel or copper must be avoided. These conditions make the cost relatively high.

Why Cross Bonding Is Necessary

If every joint on a rail was properly bonded and maintained there would be no necessity for cross bonds between the rails of a track. But bonds and joints fail, and by cross bonding the consequent bad results are minimized. In case of a double track road the two tracks should have cross bonding between them for the reason mentioned above and also because the load on the two tracks can be thus equalized. Any type of bond terminal may be used but the conductor is usually solid as it is not subject to as much vibration as the point bond. Cross bonds are spaced from five to twenty per mile of track, the spacing being the closest in large city systems. In Chicago approximately 15,000 60-in., No. 00, ¾-in. pin-terminal bonds are used, and by ordinance they must be spaced not to exceed 330 ft. apart. Between the tracks an auxiliary copper cable of at least 500,000 circ.mil is used on all straight track, and each cross bond is attached to this cable. This results in extremely good equalization of current between the tracks.

Track special work needs replacement more frequently than straight track, and to maintain the integrity of the return circuit while this is being replaced, some form of bonding around the special work is usually adopted. Also on account of the numerous joints in the special work its internal resistance is high as compared with the straight track.

The best form of bonding may be illustrated by the standards adopted by the Board of Supervising Engineers and used in Chicago. There 129-lb. rails having a copper equivalent of 1,500,000 circ.mil are used for all straight track. The four rails, together with the auxiliary cable mentioned under cross bonds, set a requirement of 6,500,000 circ.mil copper equivalent through the special work. This is secured by: (1) Using a 1,000,000-circ.mil cable through the special work for each rail, the ends of each of the four cables being electrically welded to the straight track rail beyond the last bolted joint, a total of 4,000,000 mils. (2) Each internal joint is bonded with a No. 00 pin-terminal bond, a total of 532,400 circ.mil. (3) Copper equivalent of eight 12-bolt joint plates, a total of 2,000,000 circ.mil. Over 25,000 cable welds have been made in Chicago in carrying out this plan.

Testing of Rail Bonds Is a Simple Proposition

The testing of rail bonds is essentially measuring the resistance of the rail joint across which the bond is placed. This is commonly done by measuring the drop across the joint and comparing it with the drop over an equal length of unjointed adjacent rail. This can be done by using two voltmeters read simultaneously, which is not convenient or accurate. Usually a testing outfit is made up by having a frame with three equidistant rail contacts attached to it, these contacts being connected to the terminals of a differential voltmeter. A zero reading then indicates that a certain length of rail, usually three feet, including the joint, has a resistance just equal to the unjointed rail. In some forms of testers the third contact is movable along the rail and may be placed to secure a zero reading, in which case the length of rail having the same resistance as the joint is ascertained. Autographic readings may be made on some testers and there are in use testing cars so arranged that by running over the line the bonds may be tested and recorded automatically. The principle of operation is the same in all cases. Sometimes there is insufficient current flowing in the rail to secure reliable indications. In such an event current must be sent into the rail from an independent source, from points beyond the tester contacts.

A common error is made in assuming that a bond is defective if a test reading is secured greater than the standard. For instance, if the drop is taken over a 3-ft. length of rail, including the joint, and a 5-ft. length of unjointed rail is necessary to balance this drop, then it is often assumed that the bonded joint is defective. This does not follow at all because the test means that the resistance of the 3 ft. of rail containing the bond is greater than 3 ft. of unjointed rail. The

bond may be 100 per cent perfect, but if the area of the bond is not sufficient to equal the copper equivalent of the rail such a result will always follow. A test of this kind means very little unless we compare the results of the test with those secured at the time of installation of the bond. Any increase of resistance of the joint may be due to a partial failure of the bond, or it may be due to a lessened conductance through the splice bars. The only way to ascertain what has happened to the bond itself is to test its contact, independently of the rail section.

SUMMARY AND CONCLUSION

All parts of the return circuit should be intimately connected together so that each part may be utilized to the fullest extent for carrying the load. Any high resistance in the return circuit is just as detrimental as one in the positive circuit, and it is bad engineering to neglect the returns because they are usually out of sight. Perhaps on most roads there would not be any financial advantage in bonding merely to save energy, as the loss might readily be less per annum than the fixed charges on the bonding investment. But this should be determined for each road, and it is quite feasible to work out a mathematical relationship which will indicate how much might be spent for bonding for the purpose of saving energy.

A more important reason for good bonding is to secure better voltage conditions. A large line drop will, of course, give low voltage at the motor terminals and cause loss in speed. To develop the same power in the motors increased current will be drawn from the line and this increased current will cause larger power losses in the motors and line. The peak load demand will be raised correspondingly. From no point of view are these results beneficial.

The leakage of current from grounded returns causes electrolysis of underground structures when these are so situated as to be in the leakage path. These leakage currents, of course, follow the fundamental electrical laws, and if our track construction has produced the highest practicable resistance to leakage, then our only recourse to further reduction of leakage is to make the track conductance the highest possible. This opens up a large field, and it is not the intention to discuss electrolysis problems except to point out their existence and cause and to suggest their fundamental relation to rail bonding. Any betterment in the return circuit will directly aid in the reduction of possible electrolytic damage.

Mr. Shoup on Railway Situation

Where Fare Has Been Raised Electric Railways Are Doing Well—Bus Trials Described—Railway Securities Have Large Values Behind Them

IN AN address before the San Francisco Chamber of Commerce on Jan. 12, Paul Shoup, vice-president of the Southern Pacific Railway and president of the Pacific Electric Railway, gave as the fundamental difficulty with the traction lines in the United States "the failure of the public generally, and also of the owners of the lines themselves, to realize that after all the traction line is a private industry, is simply an agent for the public in the furnishing of transportation. As such it should be looked upon as other agents would be who furnish private capital to carry on a public purpose to meet a public need. It should be entitled to protection, just as any other agency would be under like circumstances, and it should not be made the instrumentality of trying to collect other taxes—other than the tax necessary to maintain this industry as a carrier—as a means of transportation." In Mr. Shoup's opinion if the electric lines were freed from their burdens for paving, licenses, etc., it would make a very marked change in their net earnings and therefore in the values of their securities in the market.

Mr. Shoup spoke optimistically of the results on the California roads where the fare had been raised. Referring particularly to his own road, he said that in Stockton and San José the 6-cent fare had given very satisfactory results, the San José property doing better than for twenty-four or twenty-five years. The Fresno Traction Company is also doing as well as to gross and net revenue as at any time in its history, due partly to the increased prosperity of Fresno. The same situation does not prevail on the Pacific Electric Railway, but the State Commission report on how expenses might be reduced through public co-operation on that property offers hope.

Mr. Shoup spoke enthusiastically of the safety car. He said that the companies with which he was associated had had fifty in use for about a year, and were planning to buy 100 more. He also referred to experiments with installing buses as feeders on several of the properties, including Fresno and San José, but they have been failures. "So," Mr. Shoup said, "every one who believes that the jitney would succeed the electric lines may dismiss the subject or doubt from his mind at this time, so far as the present stage of development is concerned, anyway. The great difficulty is that they do not stand up under the wear and tear when you put them into the same kind of service as that which an electric car performs, and ask them to stop at every street corner to take on or let off a passenger or two, or run a hundred yards or two or three hundred yards and stop again, and we can dismiss the jitney as a serious competitor of the electric lines, provided it is subject to the same regulations by the public and made to accept the same obligations by the public that the electric lines have to accept."

Mr. Shoup said that the business of the California electric railways at the present time is very good, so far as gross earnings are concerned; the difficulty is with the net earnings. In spite of this fact, the state has raised its tax from 4 per cent to 5¼ per cent of the revenue. He believes the public sentiment in California is sympathetic with the roads and favorable to private ownership, in spite of the example which has been set by San Francisco.

Speaking of the investment side, Mr. Shoup said there were more than 3,000 miles of electric track in California, against which $155,000,000 in bonds had been issued. He estimated it would take $200,000,000 to replace the capital which had been put into the lines, and $300,000,000 to reproduce them at the present high prices of labor and materials. With these values and in view of the real estate owned by the companies and covered by the mortgages he believes that the securities are selling very cheaply today. In conclusion he said, referring to the electric railways, "There is not a cloud on the horizon which indicates that the industry is going to be wiped out. The public cannot get along without them, and it will have to take care of them."

C. E. R. A. Meets at Louisville

Principal Operating Topics Discussed Were Rail Bonds, Safety and Economy of Electrical Energy on Cars—Organization of Electric Express Company to Serve Central States Proposed—Debate on Place for Summer Meeting

THE annual meeting of the Central Electric Railway Association was held at the Seelbach Hotel, Louisville, Ky., on March 10 and 11. As usual a number of delegates made the trip to Louisville by special through electric cars from different points in the Central Electric Railway territory. The sessions of the association were set to begin at 2 p.m. on Wednesday so as to permit many of the delegates to leave their home cities on the morning of the same day.

The convention was opened by President J. F. Collins, Grand Rapids, Mich., who delivered the annual presidential address. In it, he made a plea for greater standardization of operating practices and equipment, recommended a charge for transfers to minimize their misuse and took a stand for 10-cent city fares and interurban fares equal to steam road rates. He said, in part:

In cities where the population is 100,000 or less, tracks and special work should be of a specified weight, and in cities of a population of more than 100,000 the tracks and special work should be of a heavier type. Tongue switches should be the same in all cities, large or small. It is costly to the companies to have the present various kinds of rail, tongue switches and other special work and often, if a piece of special work becomes needed, it takes three or four months to obtain new material. In the meantime the railway company is delayed in making the needed repairs. Why not also establish a uniform rail bond for cities and another for interurbans? The block signal system used in cities where single track is installed should also be uniform throughout.

A standard order board on all interurbans should also be established. The rules governing operation should be the same, except for minor changes, to fit local conditions. This should also apply to the telephone system. This would simplify the operation of interurbans where various divisions are operated under one management, as platform men could be transferred from one division to another and could take up employment with another company without difficulty. The uniforms of the platform men should be the same, as well. Trolley wire and trolley special work should also be made standard throughout.

There is no doubt but that the type of cars for medium size cities should be the one-man car. The wheels, flanges and treads, and the trucks should be of one design. There is no good reason why one city should have a different type of truck than another. The manufacturers of cars and trucks would welcome the standard car. In cities of a population of 100,000 or more the type of car should also be standardized, although, on certain lines in large cities, one-man cars would be preferable. Interurban cars, as nearly as possible, should be of one particular design also. It is true that some interurban companies use a larger car than others.

The entrance to the larger type of city car should be exactly the same in all cases. In some of the cities passengers enter from the rear and leave from the front and rear. In other cities, passengers enter and leave from the side of the car, and again in others passengers enter from the front and leave from the side. Why not have one standard so that passengers will always know just where to enter the car? Again, it seems that almost every city has a different system of taking on passengers. Some stop at the far crossing, some at the near crossing, others make special stops where poles are painted a certain color, etc. In my opinion, it would be to the interest of all the city railway companies to stop on the near crossing. In cities where the skip-stop system is used, enamel signs should be hung on the span wires reading: "Cars stop here." Under present conditions, transients when arriving in a city must learn from a policeman or some citizen as to where to board a trolley car.

It seems that most managers of city railway properties pay very little attention as to how transfers are handled. In a great many of the cities in which I have had occasion to examine the transfer system, I have found pads of transfers in such places as the stoves during the summer season and in sand boxes and under the seats in the winter season. I have also found that conductors are allowed to help themselves to transfers in the dispatcher's office. You will often hear railway managers say that transfers have no value when they are not registered. Of course this is not a fact. Transfers have a value. I am a strong advocate of charging passengers for transfers, either 1 cent or 2 cents, as the case may be, thus giving transfers a greater value than at the present time. I also recommend a closer check on the dispatchers and conductors in the matter of handling transfers. There should also be a close supervision of duplex tickets issued.

During the Government's control of the railroads, the interurban lines have been a clearing house in the matter of freight and ticket agents for the steam railroads. Therefore, it has become necessary on a good many interurban divisions to break in many new men and to employ what is known as traveling ticket and freight agents for the purpose of instructing the new agents as to their duties. It was also found necessary to increase the number of traveling auditors to check the stations more frequently. The method of employing traveling freight and ticket agents and having the stations checked more frequently has met with considerable success and I heartily recommend this system as reducing the number of shortages to a minimum.

I also heartily indorse the further development of through freight service to all member companies, within the Central Electric Railway Association territory, as well as the establishing of complete express service within the territory of the association.

With the increase in costs of material and labor that the city and interurban lines are compelled to meet, it is going to be necessary that all city lines charge 10 cents per ride, it being a fact that money is worth only one-half of pre-war values. The interurban lines should charge per mile the same as steam roads. I predict in the near future a 4-cent-per-mile rate per passenger, and a 25 per cent increase in freight rates.

There never has been any good reason why interurban lines should not charge the same rate as the steam lines. With their frequent service and delivery of passengers in the down-town districts, they would handle the same volume of business as at present with the lower rate. This has been demonstrated, because, before the war, the steam roads and electric lines both charged 2 cents, and when the steam roads went to a 3-cent fare their business did not suffer.

Association Considers Operating Topics

The principal technical topic considered at the Wednesday afternoon session was that of rail bonding, as presented in a well-received paper by Ralph H. Rice, principal assistant engineer Board of Supervising Engineers, Chicago Traction. This paper, which is published in abstract in this issue, was followed by prepared discussions by M. B. Lambert and J. S. Hagan of the Westinghouse Electric & Manufacturing Company, Ralph W. Palmer of the General Electric Company, E. W. Rowland of the Ohio Brass Company, and R. J. Custer, Interstate Public Service Company, Indianapolis. Abstracts of the papers by Messrs. Rowland and Palmer are printed in this issue; those of the others presented will be printed later.

At the end of this discussion, the report of the committee on express service was presented. H. A. Nicholl, Anderson, Ind., chairman of the committee, told of the work it had done in developing the possibilities and

considering the advisability of organizing an electric railway express company with some such title as the American Electric Railway Express Company. He said that a majority of the companies of the Central Electric Traffic Association were in favor of such a plan and that it offered a greater opportunity for the electric railways to increase their earnings than any other character of transportation service. The committee is now sending out a questionnaire to member companies to ascertain how much business can be expected from manufacturers and other shippers from the territory served by each road. An effort is also being made to estimate how much capital will be required to establish and handle the business such as that involved in the purchase of motor trucks for pick-up and delivery service, the building of terminals and for additional rolling stock, etc. This report, Mr. Nicholl said, should be considered as constituting simply a progress report. Mr. Nicholl added that the committee hoped to have a complete report ready for the summer meeting.

Harry Reid, Louisville, Ky., then brought up the plan of the National Safety Council for nationalizing and standardizing the accident prevention work of the electric railways and introduced James Harmon, safety engineer Interstate Public Service Company, to speak further on the subject. After a brief address Mr. Harmon offered a resolution that a committee be appointed to work with similar committees from other electric railway associations and the Council in formulating a plan for promoting safety work more consistently and forcefully.

This resolution was adopted and President Collins said he would appoint the committee at the Thursday session.

Next Meeting Place—Election of Officers—Banquet

A lively discussion followed the announcement that the executive committee, at its meeting Wednesday morning, had decided to hold the summer meeting at the Ottawa Beach Hotel, Macatawa Park, Mich., and not to have the popular and customary boat trip. The delegates seemed loath to substitute anything for the Great Lakes boat trip, though someone did make the suggestion that the boat be routed mainly through Canadian waters. Charles L. Henry admonished the members to consider the best interests of the association rather than the pleasure of the outing as the primary purpose of the meeting, but a motion was passed requesting the Executive Committee to reconsider its decision at the March 11 session of the committee.

The nominating committee of which F. D. Carpenter, Lima, Ohio, was chairman, then presented the following recommendations for officers for the ensuing year and the secretary was instructed to cast the unanimous ballot of the association electing them:

President, Robert I. Todd, Indianapolis.

First vice-president, A. C. Blinn, Akron.

Second vice-president, E. J. Burdick, Detroit.

Members of the Executive Committee: F. D. Carpenter, Lima; Charles L. Henry, Indianapolis; H. A. Nicholl, Anderson; S. W. Greenland, Ft. Wayne; G. T. Seely, Youngstown; W. S. Rodger, Detroit; F. W. Coen, Cleveland; J. F. Collins, Grand Rapids; Harry Reid, Louisville; C. B. Kleinhaus, Toledo; L. G. Parker and H. E. Rasmussen.

The annual banquet Wednesday evening was attended by two hundred. President Collins acted as toastmaster and Ex-Judge Arthur Peter, Louisville, made a short address about "Other Days."

Secretary and Treasurer's Report

At the session of the association on Thursday morning Secretary-Treasurer Nereamer presented his annual report. An abstract follows:

The interurban railway membership of the association, as shown in the report for 1918, consisted of 63 lines operating 4,814 miles and two city lines. During the past year there have been several changes in the interurban lines, such as consolidations and separations, which leaves the net result of membership in this association sixty-four lines and 4,364 miles, with two city lines, an increase of one line and 50 miles.

During the year 1919 we had 155 supply members as against 126 in 1918. This is an increase of 29 members.

The receipts and disbursements for the year 1919, both totalling $9,398.97, are as follows:

Receipts:	
Cash on hand, Jan. 1, 1919	$962.12
Interurban lines	4,962.51
City lines	200.00
Supply members	1,550.00
Sale of buttons	20.00
Central Electric Traffic Association	1,084.25
Central Electric Railway Accountants' Association	12.40
Sale military efficiency and defense maps	87.20
Annual dinner	45.95
Returned by Summer Trip Committee	182.38
Fall meeting dinner	12.75
Interest	278.41
Disbursements:	
Pay roll	$4,320.00
Traveling expenses	531.52
Stationery and printing	1,840.16
Boat trip, advertising, etc.	361.53
Postage	162.43
Telephone and telegraph	88.04
Central Electric Traffic Association, miscellaneous	50.32
Central Electric Railway Accountants' Association, miscellaneous	15.00
Office fixtures and incidentals	27.00
Freight and express	3.73
Office rent	240.00
Legal expense	35.00
Investments	500.00
Annual dinner	9.40
Taxes and insurance	5.00
Cash on deposit	609.94

It will be noted from this statement that the cost of all material used by the association has greatly increased, while the operating expenses of the association remain the same as the preceding year. There was expended by the committee in charge of the summer meeting $361.53 on account of expenses incidental to the boat trip.

The only investment during the past year was the purchase of $500 of Victory Loan bonds.

A statement of the expenses of the Central Electric Railway Accountants' Association follows:

Total expenses for the year		$196.70
Received from sale of pamphlets	$3.40	
Dues at $5 per annum from two lines not members of the Central Electric Railway Association	10.00	13.40
		$183.30

As an explanation to the item covering Stationery and Printing and the Miscellaneous charge against the Central Electric Traffic Association, a statement is submitted herewith of the receipts and expenses of that association for the year 1919:

Received from sale of tariffs	$1,084.25	
Traveling expenses		97.70
Stationery and printing		913.48
Postage		25.00
Telegraph and telephone		15.49
Freight and express		9.83
Legal expense		35.00
Dues from member companies	82.67	
Surplus		70.42
	$1,166.92	$1,166.92

A statement of the current assets and liabilities of the association for the year just ended follows:

Current Assets				
Cash on deposit			$609.94	
Investments	Liberty bonds	$2,000.00		
	Railroadmen's Building & Savings Ass'n.	3,046.40	5,046.40	
Due from members			153.80	
				$5,810.14
Liabilities				
Balance				5,810.14
			$5,810.14	$5,810.14

Your attention is called to the fact that the financial status of this association is the best that it has been since its organization, and this result has only been achieved by carefully watching every cent that has been spent for any purpose whatever. No unnecessary supplies have been purchased through the secretary's office. If the present prices of paper and cost of printing are kept up, the next showing, a year hence, will not be as good as it is now. We have arrived at a place where the continued advance in everything we use will, during the coming year, eat into our surplus unless the income of the association is greatly increased in some manner. The work in the secretary's office has been increasing from time to time, and from present appearances it will probably be necessary to have additional help before another year is ended. This, of course, will call for more income from the members or the use of the permanent investment.

In closing, your secretary and treasurer desires to thank the officers, committees and members for the assistance given him in the discharge of his duties durng the year just past.

A report of the technical sessions on Thursday will appear in a later issue.

Types of Rail Bonds*

BY R. W. PALMER

Railway Supply Department General Electric Company, Schenectady, N. Y.

RAIL bonds may be divided into two groups: Those for the head of the rail and those for the web or base of the rail.

U-shaped bonds for attachment to the head of the rail were originally soldered. These were followed by different forms of stud terminal bonds mechanically attached to the rail head, but both forms have given way almost entirely to welded or brazed types of bonds, due to the rapid advances made in the art of welding by oxyacetylene and the electric arc.

The facility with which these bonds can be applied is sometimes misleading, as regards actual economy. In other words, there is a tendency to put too much stress on the first cost of short bonds with the idea that it is cheaper to replace them, due to one cause or another, than it is to adopt a longer and more expensive bond in the first place. Unfortunately, the length of bonds for the head of the rail has become fixed, or almost so, by competition between manufacturers, at 7½ in. and smaller, with a capacity usually of No. 0000, although roadway conditions vary to a considerable degree. Therefore, regardless of the manner in which the bonds are attached at their terminals, the same length of bond will have a long or short life, due to rail joint movement, depending upon the conditions found on any particular property. Yet this very important point of length of bond is often completely ignored by the railway man when it comes to comparing one manufacturer's price with another.

Before discussing the merits of welded types of bonds, it will be well to consider briefly the selection of bonds in the second group, or those for other parts of the rail than the head. In this classification we have the well-known "concealed" types of bonds which are installed under the splice bar, also the long bonds installed outside of or around the splice bar. The concealed type of bond is widely used and has about as many advantages as disadvantages. Undoubtedly, the simplest way to apply the concealed bond is by mechanical means, with compressed type or pin type of terminal, in holes drilled in the rail web. Such bonds have been welded only to a very limited extent, and the advisability of welding them to the web is still an open question, for the reason that the spot welding of rail webs in so far as it contributes to rail fractures is a matter which still gives many engineers concern. Moreover, it is difficult to design terminals which are suitable in shape for welding and at the same time will fit beneath the splice bar. The chief consideration, where concealed bonds are used, is the matter of space available. Too often the bond takes up all the space in a new joint, so that when the splice bars wear and are drawn in, the bonds are crushed. The space which dictates the size and forms of bond is that under a worn-out splice bar.

The long bond applied outside of and around the splice bar is easily attached by the various welding methods and is undoubtedly superior to other types where the bonds are not exposed and subject to theft. This form of bond has been used for a number of years both in the solid conductor and the stranded type. With this type of bond, it should be remembered, the cost to the railway is not exactly proportioned to the length of the bond. The principal expense in making this bond is the terminals, so that the cost of a bond installed does not increase in proportion to the length of the bond, and we urge that this point receive careful consideration.

BONDS MUST BE INSTALLED PROPERLY

Of equal importance to the selection of bonds is the selection and training of men to install them properly. Many bond failures can be traced to improper installation, the work often being intrusted to track laborers or others who have no conception of the importance of the work they have in hand. This point was brought forcibly to the writer's attention while rebonding an interurban property because of excessive drop in the return circuit. In going over the track we found a number of joints which tested open, indicating that the bond was either broken or missing entirely, but when the angle plate was taken off the bond was seemingly in as perfect condition as when installed, a number of years previous. Further examination, however, showed that the terminals as well as the holes in the rail were badly corroded, indicating that the holes had been drilled too large for the size of the terminals used.

To secure the best results with expanded terminal bonds, the terminals should be accurately milled to size and the holes in the rails reamed at the time of installation to give a snug fit. It is also important that the bond terminals should be properly cleaned, after which the contact surfaces should not be touched with the hands. This precaution is necessary to prevent corrosion. Providing the bond terminals are properly expanded after these precautions are taken a very satisfactory contact can be formed and maintained during the life of the bond. The same degree of care should be exercised in connection with the installation of acetylene or arc welded bonds.

WELDED BONDS

The welding of bonds with the electric arc and the oxyacetylene flame is such an improvement over other methods that it is receiving the favorable consideration of railway engineers everywhere. Welded bonds are of three kinds, those for gas or flame welding, for metallic arc welding and for carbon arc welding. Only the flame weld and metallic arc weld types will be discussed here.

*Abstract of paper presented at annual meeting of Central Electric Railway Association, Louisville, Ky., March 10, 1920.

Flameweld bonds are made with drop forged all copper terminals and with various kinds of steel terminals mechanically attached to copper conductors. The nature of the gas welding process precludes the necessity of having forged copper terminals welded to the conductors at the factory, and this type is very little used now. The steel terminal bonds are considerably cheaper and are equally as good when properly installed, but a little more care is required when they are applied to insure all of the wires being welded together. When flameweld bonds are applied it is not necessary to grind the rail, though the surface of the rail should be coated with flux metal before the bonds are placed in position to weld. This practice insures a thorough union between the rail and the flux metal. At the same time the oxide is removed from the rail surface by the flame.

Pure copper, when used as the attaching metal with the gas flame, does not give good results. Molten copper has a very strong affinity for oxygen, and when used with the gas flame a very porous and brittle metal structure of low mechanical strength and poor conductivity results. The flux wire which we furnish and recommend is a phosphor bronze wire containing a fair percentage of tin. Phosphorus is a deoxidizer and serves as the fluxing agent. The composition is important, as all phosphor bronze wires do not give like results in gas welding.

The resistance of flameweld bonds is about 5 per cent less than that of a perfectly installed double stud or twin terminal bond, and is about equal to that of a brazed bond. Compared with the steel welding, arcweld bond resistance is about 15 per cent less. Therefore, electrically, the flameweld bond is as good, if not better, than the best. Mechanically, it is very strong.

The weld is a simple one to make, and the speed of installation compares favorably with all other types of heat applied bonds. One man and a helper, if expert, will easily install eighty bonds in a ten-hour day. The apparatus is readily portable, and in localities where a supply of gas can be maintained readily, these bonds are worthy of thoughtful consideration.

The steel-faced arcweld bond is the latest development and is meeting with much favor. This type of bond has a steel face welded to a drop forged copper terminal at the factory. This is a forward step in the problem of bonding, for the reason that the old difficulty of attaching copper to steel by some satisfactory means is done at the factory, thus leaving a steel to steel weld to be made in the field. This simplifies the matter, for this kind of welding is common.

To obtain the best results when arcweld bonds are installed, the spot on the rail adjacent to the bond should be carefully cleaned, and all rust, dirt or annealing scale removed. This work can be accomplished with the use of an old file and a steel wire brush. After the rail is prepared the bond should be clamped or held in position and the arc started at the lower edge or bottom angle formed between the terminal and the rail. The operator should carry the arc across the entire length of the terminal if possible without breaking the arc so that the first layer of deposited metal will make a firm union between bond and rail. Before applying the next layer, the operator should use a steel wire brush to remove any surface oxide which may form on top. During the process of welding the operator should hold his electrode at such an angle that for the greater part of his time he will be devoting his efforts toward the rail, inasmuch as the rail being a larger mass of metal than the bond it will require more heat to insure good penetration.

With arcweld bonds, it has been found that the best results can be obtained by using 125 to 130 amp. at a voltage of approximately 20, this being the average voltage required for successful welding with the metallic electrode.

The arcweld bond is now made in two general types: The familiar U-shape for the head of the rail, and a long flexible type for spanning the splice bars. The U-shaped bonds are furnished with round wire strand or with flat wire, and the flexible bonds in two designs of terminal, for attachment either to the rail web or to the rail base.

Equipment for Bond Installation

So far, the question of electrodes for bonding has not received as close attention as its importance deserves. Naturally, the deposited metal should be as homogeneous as possible, so as to provide the maximum conductivity for the steel. A very pure wire of high conductivity before welding is not necessarily the best after welding, as the composition undergoes a change in the arc. The desired result differs from that of most steel welds where strength is the prime consideration.

The polarity of the electrode is a much mooted subject. Good welds are obtained both ways and with the alternating current arc. It is safe to say, however, that the positive electrode acts differently from the negative electrode, and the welder has to become accustomed to handling the arc with either polarity before good welds can be made.

This brings us to the point of equipments for installing the bonds. The most popular type at present is the resistance welder, commonly called a resistor. In spite of the fact that the power wastage is large with the resistors, they meet with favor because of their inherent reliability and low cost of maintenance. The first cost is low, and they are readily portable, the wire type for 600 volts weighing as little as 80 lb. Aside from the fact that it is necessary for the electrode to be positive with this type apparatus, the high voltage permits a long arc to be held, and it is generally conceded that a long arc is conducive to poor welds. Consequently, due to what might be termed the elasticity of the arc, there is generally a lack of uniformity with the welds made with these machines.

A low-voltage rotary outfit is conceded to be the best for uniformly good welds, but a motor-generator set has the great disadvantage of weight, single operator sets weighing close to 1,000 lb. This is not at all convenient to move from joint to joint. The dynamotor is the lightest type rotary machine for the purpose, and offers the most attractive proposition both from first cost and weight standpoints.

In conclusion, I will point out the chief features of our arcweld bonds: The steel welding face is in plate form, and the copper in the terminal is directly welded to it. In the manufacture, no intermediate metal is used to join the steel and copper together, both metals being directly joined while their surfaces are in a state of fusion. No matter how hot an arc is used on the steel face, the copper will not separate from it. This is very important because it is necessary to raise the bond terminal to a high temperature to insure a weld between the electrode and the steel face.

You may wonder why we go to the expense of applying the steel welding face, instead of using a plain

copper terminal. If the problem was simply one of welding two pieces of copper together, we could do that, but when we try to weld steel and copper together, using either a steel or copper electrode, it is not successful because of the different thermal conductivities of the two metals. Unless the copper bond is preheated (and this is not feasible), it is doubtful if any electrode will be developed which will do this.

The cost of installing any particular type of bonds, having terminals welded to the rails, will vary with the cost of labor, current and conditions under which the work is done. Therefore, it is impossible to give any figures which might apply generally.

The only data which we have as to the number of bonds which can be installed in a given time are for some No. 00–26-in. arcweld bonds, applied to the base of 40-lb. rails in coal mines. Here the current for bonding was supplied from a motor-generator set mounted on a small car coupled to a mining locomotive, and a crew of three men was used. One prepared the rail and the other two took turns at welding and operating the locomotive, the other acting as helper. With this outfit an average of twelve bonds per hour were installed, and the man in charge of the work established a record of applying twenty-four bonds in fifty-five minutes. Taking into consideration the time required in moving the equipment from place to place and the difficulties encountered in doing this class of work in the mines, it is believed that the results obtained were very satisfactory.

It might be well to state that the bonding was done after the mines had ceased work for the day, so that no interference was encountered due to operation of hauling locomotives.

Which Type of Bond Is Best?*

By Ernest W. Rowland

Bond Engineer, The Ohio Brass Company, Mansfield, Ohio.

ON SOME properties the rail bonding work falls to the way department, on others the line department is responsible, while on still others each of these departments seems to switch the work off on the other to the detriment of bonding generally.

Basically track bonding is one of the most important phases of railway work. So much depends on it that it seems surprising that more attention is not paid to it. For example, consider a few of the evils that are directly traceable to poor bonding. First there is electrolysis; next in line is loss in power; next loss of voltage; then baked armatures and fields on motors, broken rails due to arcing at the joints and other effects too numerous to mention here.

As to the loss in voltage, there is probably nothing more irritating to a rider than to be compelled to sit in a car late at night with the light varying anywhere from a very dull red to utmost brilliancy. Some of this can be traced to lack of positive feeders, but most of it is due to poor bonding. And baking of armatures is an important item from a financial standpoint alone.

Comparatively speaking it is an inexpensive proposition to bond a line thoroughly. In fact a good bond can be installed for less than a dollar a joint, and when one considers the waste caused by poor bonding this cost fades into insignificance.

Recently an article appeared in one of the railway papers regarding the breaking of rails due to the arcing at the joints where bonds were broken. The author remarked that under normal conditions such joints would break in from six months to two years. His time interval is, I believe, too short, but such action does occur within from three to five years and often less. Which, then, is cheaper; to spend a dollar for a good bond which will last from eight to ten years, or to renew a rail that is burnt out every five years?

Loss in power is another important item, especially when the railway company is buying its power. An instance that came under my observation recently will illustrate this point. A certain railway in the East had one substation which was overloaded about 50 per cent of the time; so badly overloaded that the engineer in charge decided that he would have to put in additional rotaries. But before proceeding to do this he rebonded the track leading past the station and buried some old rail in the street as a supplemental negative feeder. When he had completed this work he found that he had so reduced the load on the station that it was unnecessary to install additional rotary capacity.

The foregoing leads us into a discussion of track bonding generally. For convenience all bonds may be grouped into two classes; those mechanically applied and those heat applied. The mechanically-applied bonds include the pin and compressed-terminal types; also channel pins, about which the less said the better.

As far as the pin and compressed-terminal types are concerned, there are at present no better bonds made, provided they are installed properly, but there, unfortunately, is the rub. It is fairly safe to say that on the average railway property 90 per cent of the men doing the actual work do not do it properly. And yet, if the men have been taught to do the work properly either one of these types cannot be excelled for new work. But they have their limitations. When it comes to renewing them the cost is almost prohibitive. Then, too, few of the workmen install the bonds properly. It is necessary to exercise a few precautions to make the bond effective. Water must be kept away from the bond terminal. Drills should be ground by an expert. It is well also to paint the terminal after installation.

Under existing conditions it is often easier to break a man in to install a welded bond than to train him for installing the pin and compressed-terminal types which are apparently so easy to install that it is not considered necessary to have one man do the work all the time. Hence the normal precautions are not taken. With a welded bond it is necessary to have one man who can do the work. In both the gas and arc welded types a small amount of instruction is generally all that is necessary to enable a man to install the proper type of bond. And it is a very simple matter to check the operator in his welding, because a hammer will test the welds in a perfectly satisfactory manner. On the mechanically-applied bonds the tests are electrical.

As to the relative advantages of gas- and arc-weld bonds, it is necessary for the individual to choose which is the more applicable to his property. Those properties which are distant from service stations have difficulty in getting gas, so that they have been more inclined of late to swing over to the arc weld. The arc weld bond probably requires a little more expertness in its application, but even on the smallest road these difficulties are not insurmountable.

*Abstract of paper presented at annual meeting of Central Electric Railway Association, Louisville, Ky., March 10, 1920.

As to the heat effect of the gas or arc on the rail, while there is a slight hardening effect due to both the processes, I can say, after experience of four years with the gas-weld bond, involving the installation of thousands of bonds of the gas-weld type, I have yet to see an authentic case of breakage due to the welding. Other bonding men report the same experience.

USE OF THE ARC WELDING PROCESS IN ELIMINATING BONDING DIFFICULTIES

Some companies have gone into the arc welding of rail joints within the last few years in order to overcome the difficulties attendant upon bonding. This has apparently worked very satisfactorily, but it might be well to "make haste slowly" here. After all the only test is that of time, and the time interval since the adoption of this type of joint is comparatively short. It would appear that the stress on the small welded surface would be so heavy as eventually to break the weld. This would involve more than the weld, because it would mean the renewing of a rail. This is especially true on an interurban road, where the expansion and contraction of the rails imposes an added hazard.

After all, the cheapest plan in the long run is the ordinary joint, kept tight, with a good bond, either a properly installed mechanically-applied bond or a welded bond. It would appear from conditions generally that of the two the welded bond is the better, and yet it is possible to make a mistake even in this type.

In purchasing a welded bond, either arc or gas, it is well to be sure that at least a 90-deg. scarf is presented. If an acute-angle scarf is formed on the welding surface, vastly more expert work is required in welding than when the operator has at least a right angle to work on. Again, there is a minimum effective limit to the length of a bond. Vibration tests have shown that 7 in. is probably the shortest practicable length. Below this length the breakage due to vibration increases enormously.

While undoubtedly the shorter the bond the less the resistance, the fact that there is a limit to the mechanical efficiency of the bond compels the manufacturer to forego the advantages of the lower resistance in order that he may produce a bond that is superior mechanically.

There has been a great deal of argument presented as to the relative advantages of the ribbon-type as against the cable-type bond. Tests seem conclusively to demonstrate that, all other things being equal, the cable-type bond has a longer life than one constructed of ribbons.

First of New Safety Cars Arrive in Kansas City

HEREWITH are shown the first pictures of the latest one-man safety cars used by the Kansas City Railways. In them can be seen the results of some of the changes from the "standard" Birney car which P. J. Kealy, president of the Kansas City company, was convinced would add materially to the appearance, comfort and durability of the cars and enhance their popularity with the riding public. These changes have been quite fully described in articles which have appeared in ELECTRIC RAILWAY JOURNAL, one by Mr. Kealy on page 31 of the special report issue dated Oct. 11, 1919, and one on page 998, issue of Dec. 20, 1919. The front-end loading well and stanchions, the headlining and side sheathing, the cushioned seats, and the strengthening of truck and underframe, are among the more important features. The complete car pictured above tipped the scales at the railway company's shop at 14,200 lb. and the weight of the similar double-end safety car is 16,400 lb.

The first cars used were of standard construction and had a seating capacity of thirty-five passengers.



NEW KANSAS CITY SAFETY CAR
At left, exterior; in center, interior, showing space for standing passengers; at right, rear seating arrangement.

Twenty-eight of these were fitted with fourteen of the cross seats, six on two three-passenger longitudinal seats and one on a one-passenger seat in the rear. This seating arrangement provided for a 22-in. aisle space and practically no standing room except in the aisle.

The cars of the latest type illustrated have a seat across the rear which accommodates five passengers. There are ten cross seats and two longitudinal seats in front with a total seating capacity of thirty-four. It is thus seen that by sacrificing one passenger seat there has been gained a standing capacity of approximately 8 ft. between the front row of cross seats and the motorman's railing.

In a recent issue the *Railway Review* gives some data for electric operation at the Philadelphia terminal of the Pennsylvania Railroad, where two lines are electrified, one from Philadelphia to Paoli, and the other from Philadelphia to Chestnut Hill. The combined car mileage of the two lines for one month last summer went as high as 252,216, with five detentions totaling 14 min., although the average mileage was somewhat less than this, and the average number and duration of detentions somewhat more. Of the total car-mileage the Chestnut Hill line was credited with about one-quarter early in its operation, but at present it has grown to about one-third.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Coast Division Electrified

Milwaukee Replaces Steam With Electricity on 207-Mile Division Into Seattle and Tacoma

When the Olympian, the overland limited of the Chicago, Milwaukee & St. Paul Railroad, pulled out of Seattle and Tacoma for Chicago on March 5, operation of the coast division of the Milwaukee lines by electricity was started. The electrification of the coast division adds 207.4 miles to the 440 miles previously electrified in Montana on the Rocky Mountain and Missoula divisions, making a total of 647.4 miles of the lines of the Milwaukee now operated electrically.

One Gap Still Open

The coast division just opened extends from Othello, in central Washington, to the shops in Tacoma on the Puget Sound end. The Montana electrification extends from Harlowton in the east to Avery, Idaho, on the west. Between Avery and Othello is a stretch of 212 miles yet to be electrified. When that gap is closed the Milwaukee will be operating passenger and freight service with electric motive power over 860 miles of its western lines.

All of the electric current used in the operation of these trains is generated from water power. Substitution of water power for steam, by the generation of hydro-electric energy, on the entire 860 miles means a saving in fuel which, based on the business of 1918, will be approximately 300,000 tons of coal and 40,000,000 gallons of fuel oil annually.

The power for the coast division is taken from the hydro-electric plants of the Puget Sound Traction, Light & Power Company on the west and from the Long Lake plant of the Washington Water Power Company on the Spokane River. The Puget Sound Company has three large generating stations on streams of the west side of the Cascade mountains. White River and Puyallup River are two of the sources of this power. These streams are fed by the glaciers of Mount Rainier. The third plant is on the Snoqualmie, utilizing the picturesque falls of that name, a sheer drop of 268 ft. over a basalt precipice.

Transmission Lines Linked

The plant at White River, the plant at Electron on the Puyallup River and the two plants at Snoqualmie Falls are interconnected and are in reality one huge generating machine of 114,533 hp. In addition the Puget Sound Traction, Light & Power Company has an auxiliary steam plant capacity of some 45,000 hp., making a total of approximately 160,000 hp. available at the western end of the Milwaukee system. This system of tied in plants on the west side is in turn interconnected with a similar system of like capacity on the east side of the Cascade mountains. So on the day the switch was closed connecting Snoqualmie and Long Lake there were tied into one system some 1,500 miles of transmission lines serving some 30,000 square miles of territory.

Power furnished to the Milwaukee lines from the Snoqualmie plant at the west end near Seattle, and from the Long Lake plant on the Spokane River is delivered to the railroad's transmission lines at 100,000 volts. There are eight substations between Othello and Tacoma in which the high tension alternating current is stepped down to 3,000 volts direct current for use on the motors of the locomotives. This 3,000 volt current is carried over the rails by overhead trolley wires.

First Electric Operation in 1915

The first electrification of the Chicago, Milwaukee & St. Paul lines was completed and put into operation in December, 1915. It was the Rocky Mountain division of 226 miles. The locomotives on this section had been burning coal. The following year the Missoula division of 211 miles was placed under electrical operation. This division had been operated with oil burning engines. Oil was used on the newly-electrified coast division.

River Tunnels Ready for Service

John H. Delaney, Transit Construction Commissioner in New York City, has announced that two new tunnels under the East River will probably be opened to traffic in April.

One of these is the tunnel from Whitehall Street, Manhattan, to Montague Street, Brooklyn, and the other extends from Sixtieth Street, Manhattan.

The reconstructed Brighton Beach and Culver lines can be routed through the tube from Montague Street so as to carry passengers from outlying sections of Brooklyn under Broadway, Manhattan, and as far north in that borough as Sixtieth Street.

Practically all of the track work in the Broadway-Fourth Avenue tunnel from Sixtieth Street, Manhattan, to Queensboro Plaza, Long Island City, has been finished and will be ready for train service about April 15.

As soon as the special track work at Queensboro Plaza is completed underriver service can be instituted by the Brooklyn Rapid Transit System.

Out of the East

Manager of Shanghai Tramways, on His Way to London, Studies American Lines

Donald McColl, general manager of the Shanghai (China) Tramway Undertaking, passed through New York last week on his way to London, where he will confer with the English interests that control the line in Shanghai. Mr. McColl has been in Shanghai for eleven years. He took charge soon after the line was opened. Previous to that he had been connected in turn with the Glasgow (Scotland) lines, the Lisbon (Portugal) Tramway and the London Underground.

7,000,000 Passengers a Mile

On taking charge in Shanghai Mr. McColl had to contend with a depreciated Chinese copper currency, but so successfully did he do this that the shares of the company have steadily risen in value from £5 to more than £20. He is a strong advocate of the zone system and low fares for short stages. He says that he handles in Shanghai 7,000,000 passengers per mile of road per annum. He has found trailer operation very successful. He long since saw the value of the light weight car.

Mr. McColl came across the United States from Seattle. On his way he stopped off in a number of cities to study city railway operation. He believes the city of Seattle is making a heroic effort with its municipal railway, but is of the opinion that many things still remain to be done there before the system is fully brought to meet the possibilities which exist there for the development of the riding habit.

Mr. McColl was particularly impressed with the work that T. E. Mitten is doing in Philadelphia. He found the property there in very good physical condition. He said that Mr. Mitten was doing a really big, constructive work by his development of the idea of selling rides as merchandise.

Not Affected by War

Questioned about his own problems, Mr. McColl said that he was not seriously hampered by the war. At the outbreak of hostilities he quickly ordered material and supplies ahead for about three years. By exercising a little mechanical ingenuity here and there he had been able to keep the road well up to standard.

It is his opinion that excellent opportunities exist elsewhere in China than Shanghai for the installation of electric traction with a comparatively free field to such capital as cares to go a long way from home to seek investment.

Toledo Settlement Delayed

Changes in Proposed Grant Make Settlement Measure Impossible of Adoption, According to Mr. Doherty

In the rush to get the proposed cost-of-service ordinance for a settlement of the railway problem at Toledo, Ohio, before the Council for preliminary action, a mass of hopeless difficulties has entered into the fight which will delay the submission of the plan to the voters till Aug. 10, at least. The negotiations have been further complicated by the injection of the wage dispute and possibility of higher fares into the franchise tangle.

Last-Minute Modifications

The commission appointed by Federal Judge John M. Killits to prepare a cost-of-service plan, in its final meetings, added a few more provisions to the ordinance which had previously been made public. In addition to the feature of a premium for economical operation added to the measure last week, the commissioners inserted two more clauses into the ordinance which relate to the purchase of power by the new Toledo Street Railway, created by the ordinance, and the conditions under which the ordinance, if ever made operative, may be forfeited.

The power section provides that the contract for current shall run between the Toledo Street Railway and the Acme Power Company, which now supplies current to the Toledo Railways & Light Company, which then retails to consumers. The idea of this change in the contract form of the ordinance is to limit the Doherty interests to a single profit for electric power.

The forfeiture provision gives Council the power to declare the whole contract void if the courts declare any one of the following five salient points of the measure invalid:

1. The schedule of rates of fare.
2. Valuation of the property of the Toledo Railways & Light Company.
3. City control of service.
4. City's right to inspect the books and accounts of the company at all times.
5. The right of the city to buy the property by direct purchase or condemnation.

In the event one or more of these parts of the ordinance are contested by the company and held by a court to be invalid, then it is provided that Council has the right to declare forfeiture of the entire franchise grant, subject to the charter right of referendum. The company, however, is given no such contesting right.

Transportation Engineer Proposed

In the event the city sinking fund trustees are held by a court as not eligible to hold amortization funds of the company a provision has been added giving Council the right to select some bank or trust company as trustee. And in case it is decided that it is illegal to invest funds in stock of the company there is a provision allowing investment in other standard securities.

If the creation of the office of transportation commissioner is illegal it has been provided that the city can place his duties with other city officials.

With these corrections and with the insertion of the city's valuation figures—$7,111,336—the ordinance was sent to the printer and offered to Judge Killits to be submitted to Council. The judge has consented to give the company additional time to make objections to the new ordinance and he has also asked the commissioners to modify the ordinance in keeping with these suggestions if made in writing before April 8.

The final ordinance will then be handed to Judge Killits, on April 24, after which it will be submitted to Council and later to the voters.

The Council at its meeting March 8 passed a resolution in which it joined with Judge Killits in the extension of time for the purpose of getting written objections and remedies from the company.

Mr. Doherty Objects

Henry L. Doherty, in a telegram to the commissioners, declared, "What purports to be the final draft contains several provisions which would make it impossible for us to accept the ordinance." This indicates that Mr. Doherty will insist on several changes in the measure as it now stands. Mr. Doherty also referred to the ordinance as "hopeless." He said that legal talent would advise against the purchase of securities as unsafe, that new attorneys couldn't understand the ordinance, that he couldn't accept it in its present form, that the city couldn't afford to do so either, that sections of the draft are in conflict and that it is unworkable. Mr. Doherty suggested submitting the whole matter to a legal specialist as a referee.

The franchise matter was further clouded when Mr. Doherty and Frank R. Coates, president of the Toledo Railways & Light Company, in conference at New York, opened the proposals for wage increases filed by representatives of union labor. The Brotherhood of Electrical Workers demand $1.12½ an hour for foremen of linemen, $1 an hour for linemen, 75 cents an hour for groundmen and emergency track repairers, and 65 cents an hour for chauffeurs and drivers. The Amalgamated Association demands 70 cents an hour for all men having been one year in service and an increase generally of about 40 per cent for all other employees.

Mr. Doherty declared that these demands would mean an increase in railway fares. He said:

> The increased wages demanded by the railway operators alone, aside from the electrical workers employed in the railway department, would amount to more than 1½ cents per pay passenger, and whatever increase of wages is agreed upon will have to be added to the railway fares.

Mayor Cornell Schreiber immediately declared that the city would fight any increase in fares. The fare is now 6 cents with a 2-cent transfer charge. The initial fare under the new franchise is 6 cents with 1-cent transfer charge, and the maximum is 7 cents and a 1-cent transfer charge.

At present, the cars in Toledo are operating under the extension of the ouster ordinance, passed by Council, and an order of the federal court. In case of a wage dispute the case will immediately be thrust into the federal court for settlement.

Advocates of municipal ownership are looking for an early decision from the Ohio Supreme Court in the city's test case to determine whether it has power to issue bonds for the purchase of the railway, pledging the general credit of the tax duplicate of the city.

Electric Railway Case Before New Kansas Court

The Amalgamated Association has filed a complaint with the Kansas Court of Industrial Relations, making the Pittsburgh & Joplin Railway, respondent. The union alleges that the company is now and has been unlawfully failing to pay a fair, living and reasonable wage and has thus endangered the continuous and efficient operation of the utility named. It contends in short as follows:

> That the association has used every diligent effort to make a settlement of the controversy.
>
> That the respondent has failed, neglected and refused to make a settlement or come to a fair agreement.
>
> That failure, neglect or refusal to make such settlement will lead to further dispute and endanger the continuity and efficiency of operation of the utility and will lead to further disputes and produce strife and disorder and endanger the public peace, health and welfare.

The union requests the court to require the company to answer charges; make and establish a reasonable wage pending investigation; make due investigation of the charges contained in the complaint and after hearing to "make and prescribe such orders, rules and regulations for conducting such business as shall be just and reasonable and effect such other relief as to this honorable court may seem just and proper."

This is the first case affecting an electric railway to come before the new court for the settlement of industrial disputes brought into being by the last Legislature at the behest of Governor Allen. The union has filed with the court its former agreement dated Aug. 1, 1917, and purporting to expire on Aug. 1, 1920. No date for a hearing has been set by the court.

On July 31, 1918, the War Labor Board handed down a finding granting the trainmen on this road 38 cents an hour for the first three months of service, 40 cents an hour for the next nine months and 42 cents thereafter. For other employees a minimum of 42 cents an hour was fixed, with an increase by the same percentage that the maximum of the wage scale paid motormen and conductors was increased by the award.

City and Railway Battle It Out

One Side Charges Bad Faith and Other Makes Promises That Would Be Fine If Fulfilled

The officials of the Detroit (Mich.) United Railway and the supporters of Mayor Couzens' municipal railway plan are agreed upon the point that extensions to lines in Detroit are greatly needed. Following the announcements of the routing of the proposed municipal system, Detroit United Railway officials made a statement of the company's attitude in regard to the much needed extensions. Additional extensions which the company believes are needed to meet the immediate surface line requirements of the city are described.

Company Suggests Extensions

The suggested extensions are based not only on the experience of the transportation men and engineers of the company, but also embody many suggestions that have been made by city officials and former Railway Commissioners to accomplish the development of the city as a whole. They are subject to such alterations or changes as the Common Council might direct, the company maintains.

The company expresses its readiness to construct about 130 miles of extensions and fully to equip them with cars, power houses, yards, carhouses and other facilities. It also agrees to operate them as a unified system, under one rate of fare and liberal transfer arrangements under any reasonable arrangement that may be entered into with the public.

In discussing the municipal ownership plans, officials of the company express the belief that the Mayor's estimated costs of construction are grossly insufficient. The fact is emphasized that since the Mayor's estimates were made, the price of rails has advanced $5 a ton, and that no new promises for delivery can be obtained until after 1921 for city rails. An equally difficult situation covers steel for car building, and costs that enter into the operation of the lines have advanced so that it is believed the Mayor's estimates of operating expenses are entirely too low.

Company Has Doubts

The company asks where the $500,000 will be secured to be laid aside annually for thirty years to pay the $15,000,000 bond issue, since during the first year and perhaps the second and third years during construction, it can not be collected from the car riders for there will not be many on an incompleted system. Any loss for any reason puts the burden on the people and the people's property is liable for the loss since the people's property stands mortgaged until all the bonds are paid.

In referring to the Mayor's alleged statement that the $15,000,000 in bonds for the municipal lines will have back of them $15,000,000 worth of physical property and that besides this the bonds will be backed by a "perpetual franchise from the city," the Detroit United Railway states it has assumed that what the Mayor had in mind was a piece meal railway for, by and of the people of Detroit. If the plan is something else the whole situation will have to be viewed from another and even more startling angle. In this connection it says:

> This looks as if not only the cat but all her kittens got out of the bag. The bonds, when issued, go to the bondholders. Back of the bonds will be a perpetual franchise from the city. The bondholders to have as protection a perpetual franchise behind the bonds they hold. And no rate of fare mentioned in the franchise!

The question is raised as to who are to be these bondholders, with no limit to the rate of fare, when the Mayor refuses to discuss a limited period franchise for the Detroit United Railway at a fixed fare, and even refuses to consider the Tayler plan that fixes fares and service for the operating company.

Council Member Defends City's Plan

In speaking in favor of the Mayor's plan, a member of the Council reviewed the long series of dickers whereby the city granted the Detroit United Railway concessions in the hope of getting improved service. This member maintained that the company could have improved service any time in the past and have reduced congestion in the center of the city. He further contended that instead of so doing the Detroit United Railway used the plea of congestion to obtain concessions from the city.

The proposition presented by the Mayor, it is stated, is the first one ever before the people entirely free from some proposal to grant additional rights to the Detroit United Railway. The city takes nothing away from the company. It is claimed that the Detroit United Railway is now offering to build extensions and make other improvements that should have been achieved years ago. The value of these promises, it is stated "are written in an undeniable record of steel and iron," since in the city of Detroit only 9 miles of extensions have been constructed since 1910.

Mayor Couzens' plan has been indorsed by the Detroit Federation of Labor and a copy of the resolution will be sent to every affiliated union with the request for support of the plan. This action is in opposition to that of the local Amalgamated Association.

The question has been raised regarding the adjustment of any differences as to wages of men employed on the proposed municipal lines. It is believed by the city's chief executive that in the event of municipal ownership becoming a reality, the city would have to deal with the federation as representing the men, and that he would have no legal right under the charter to interfere with the organization of the men.

According to Corporation Counsel Wilcox a strike of railway men would mean resignation of their positions. Under the home rule act, civil service would have to be installed in a municipal system as soon as possible and if the men left their positions they would have to be re-examined before being reinstated. The opinion was also expressed that increases in wages could be granted only once a year, when the budget was being considered.

Ex-Governor Raps Union Rule

Former Governor Joseph M. Brown of Georgia has reprinted in pamphlet form his speech "The Supremacy of the Law" made at Atlanta on Oct. 27, 1912. He also issued in pamphlet form "An Appeal for Just Laws and for Their Impartial Enforcement."

In the "Supremacy of the Law" Mr. Brown expresses the opinion that when a State charters a public utility it not only permits but commands the operation of the utility for the benefit of all the people, and that whoever prevents such operation, thereby impeding public travel and paralyzing the public commerce, puts himself in rebellion to the law.

In "An Appeal for Just Laws," which is addressed to the Senators and representatives in Congress, Mr. Brown deals with the history of the Amalgamated Association in Atlanta. It is largely a review of organized labor's misdeeds. Mr. Brown makes it plain that he has no "general complaint" against President Wilson. He says:

> My criticism is restricted to his toleration of acts plainly against the Constitution and laws, and against the cardinal rights of the public, by some of the labor unions, which acts are sternly forbidden to be done by other citizens, or inhabitants, of our country and which, if done by the latter, are punished through the process of law. Therefore, the result of President Wilson's course, as above indicated, is to establish for certain organizations, or combinations of people, preferential privileges over those allowed to all other inhabitants of the United States.

Mr. Brown, who has been characterized as the "most insignificant looking person in the United States," is one of the outstanding public figures of the South. He has been the storm center of the greatest political fights in the South during the last generation. Despite this it is said he has never had the temerity to take the stump and make a public speech. Recluse-like in his habits and nature, "he has fought his battles on paper and fired his shots with a virile pen from a farmhouse that nestles in the mountain shadows of northern Georgia." Mr. Brown is the son of a former Governor. He was graduated from Oglethorpe University in Atlanta and studied law at Harvard. Among his many other activities he has been connected with the Western & Atlantic Railroad and is a former Railroad Commissioner of Georgia.

Paving Suit Lost

Under Franchise Milwaukee Company Must Repave with Asphalt Instead of with Macadam

The United States Supreme Court on March 1, 1920, held that there was a contractural duty for the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., to repave, arising from the acceptance of the franchise, and that the language of Section 2 of the franchise was not distinguishable from that involved in earlier cases in which it had held that a duty to keep "in proper repair" without qualification was broad enough to require paving and repairing with the same material with which the street was repaved.

The paving had been ordered on Nov. 8, 1915, by a city ordinance after the city had laid such a pavement on all of the streets except the railway zone. Up to that time the street had been paved from curb to curb with macadam. The company admitted that the railway zone was in need of repaving at that time, but it insisted that under an ordinance of Jan. 2, 1900, which constituted its franchise to lay tracks on Center Street, it was entitled to repave with macadam and could not be compelled to repave with asphalt.

After referring to the history of the case, which had been decided by the State courts in favor of the city, the Supreme Court considered the matter under four heads. Under the first head the court said that the obligation in the franchise for the company to repair "with the same material as the city shall have last used to pave and repair these spaces and the streets" did not excuse the company from paving with asphalt. Otherwise, said the court, "this would put upon the city the burden of paving the whole street in case of any innovation in paving save by agreement of the company with the city. This is not a reasonable construction of the provision." Under the second head the court referred to the claim of the city that the use of macadam by the company on its strip would be injurious to the asphalt paving on the rest of the street because water would seep through the macadam and get under the asphalt. Hence, the court declared it could not say that the city's "requirement that the railway zone be paved like the rest of the street with asphalt upon a concrete foundation was inherently arbitrary or unreasonable."

Under the third head the court considered the claim of the company that the return being earned on its property was less than a reasonable one and that to improve the additional burden of paving with asphalt would deprive it of its property in violation of the fourteenth amendment. On this point, quoting cases, the court said:

> The Supreme Court of the State answered the contention by saying, "The company can at any time apply to the railroad commission and have the rate made reasonable." The financial condition of a public service corporation is a fact properly to be considered when determining the reasonableness of an order directing an unremunerative extension of facilities or forbidding their abandonment. But there is no warrant in law for the contention that merely because its business fails to earn 6 per cent upon the value of the property used, the company can escape either obligations voluntarily assumed or burdens imposed in the ordinary exercise of the police power.

The fourth defense raised was that the ordinance was void because it denied equal protection of the laws. This contention rested upon the fact that since entry of the judgment the Supreme Court of the State had decided *Superior v. Duluth Street Railway Company*, 166 Wis. 487, which the company alleged was not reconcilable with its decision in this case. On this point the Supreme Court said that it could not see a close similarity between the two cases. Continuing, it said:

> However that may be, the Fourteenth Amendment does not in guaranteeing equal protection of the laws, assure uniformity of judicial decisions, *Backus v. Fort Street Union Depot Company*, 169 U. S. 557, 569, any more than in guaranteeing due process it assures immunity from judicial error. *Central Land Company v. Laidley*, 159 U. S. 103; *Tracey v. Ginsberg*, 205 U. S. 170. Unlike *Gelpcke v. Dubuque*, 1 Wall. 175, and *Muhlker v. New York*, 197 U. S. 544, where protection was afforded to rights acquired on the faith of decisions later overruled, the company seeks here to base rights on a later decision between strangers which, it alleges, is irreconcilable on a matter of law with a decision theretofore rendered against it. The contention is clearly unsound.
>
> As we conclude that there was a contractural duty to repave arising from the acceptance of the franchise, we have no occasion to consider whether there was, as contended, also a statutory duty to do so arising under section 1862 Wisconsin Statute, which provides that street railways shall "be subject to such reasonable rules and regulations * * * as the proper municipal authorities may by ordinance from time to time prescribe."

Justices Pitney and McRenolds filed dissent of the opinion handed down.

Must Meet Franchise Conditions

The United States Circuit Court of Appeals at New York has reversed a decision of Federal Judge Chatfield which enjoined the Board of Estimate from revoking the franchise of the Manhattan & Queens Traction Corporation because of the company's failure to extend its line from Jamaica to the city limit. The opinion was written by Judge Rodgers. It was concurred in by Judges Hough and Manton.

When the board, about a year ago, ordered the company to extend its line the company asked for receivers, and the receivers obtained the injunction freeing them from building the extension. Under the decision of the Circuit Court the city has now the right to take over the road.

The company obtained its franchise in 1912 to operate from Jackson Avenue and the Queensboro Bridge Plaza along various streets to the Nassau County line. It refused to continue construction beyond the Long Island Railroad station in Jamaica. The court says the franchise was an entire franchise and that the line must be built and operated when the city so directs.

Corporation Council Burr of New York City says that the decision means that "every corporation must keep its contracts with the city or suffer forfeiture."

Wage Case Closed

Atlanta Company Concludes Its Testimony Before Arbitration Board—Increase in Fares Necessary

The wages of railway employees in Atlanta, Ga., have been increased in greater ratio than the advance in the cost of living, and if another increase is allowed at this time there must be an increase in fares to meet it. Resting on this contention the Georgia Railway & Power Company on March 5 concluded its case before the board of arbitration that had been appointed to consider the advisability of a salary advance for trainmen. Judge John D. Humphries, umpire of the board, announced that the board would consider the case when the testimony presented had been fully transcribed. A decision will probably not be rendered before April 1.

Preston S. Arkwright, president of the Georgia Railway & Power Company, and H. M. Atkinson, chairman of the board of directors, represented the company. They presented figures to prove that at a 6-cent fare, the present rate, the company could not afford to pay the men any advance in wages. Even at 6 cents, the company executives stated, the corporation is not able to break even on railway operation. Therefore, it was pointed out, that if the board decides in favor of the employees and grants an increase in pay there must necessarily be an increase in fares to meet the added expense.

In presenting the company's side of the case Mr. Atkinson said:

> The company gets absolutely nothing from the last increase in fares to 6 cents. The additional revenue goes to the employees in increased wages.
>
> The railway is being run today literally for the public benefit. We are paying no dividends and stockholders are getting nothing.
>
> The fixing of wages and rates ought to be in the hands of some governing body. In my opinion it would be wise in the State of Georgia, to put the power to fix both these factors in the hands of the State Railroad Commission.
>
> Considering the money spent on wages, material, power, damages, taxes, interest, depreciation and miscellaneous items in 1919, the company paid out $1.03 for every $1 it took in under the 6-cent fare.

These were among the most important points made by Mr. Atkinson during his testimony.

Mr. Arkwright set forth detailed figures showing the system of wages for motormen and conductors, indicating that salaries have been advanced in the past few years in a ratio that more than covers the advanced living costs.

The arbitration board consists of Judge Humphries, of the Fulton County Superior Court, who was chosen as umpire after both the company and the union had refused to accept several other men suggested for that important position. Luther Z. Rosser is arbiter for the company. Madison Bell represents the men.

The only question to be decided by the board is that of wages to be paid during 1920. All other issues arising from the 1920 contract have been settled by previous negotiations to the satisfaction of all concerned. While the

exact increase in pay asked by the men has not been made public it is understood on good authority that they ask an increase that will cost the company nearly $600,000 a year, according to figures presented by Mr. Arkwright.

Based on the number of working hours in 1919, Mr. Arkwright pointed out that an increase of only 1 cent an hour would cost the company an additional $30,000. He presented the figures for each additional cent per hour, showing that a 5-cent increase would cost the company almost $150,000 a year; a 10-cent increase almost $300,000; a 15-cent increase almost $450,000; and a 20-cent increase close to $600,000 additional.

It has since been reported from Atlanta by telegraph that the men have gone out.

Present Prices in Valuations

U. S. Supreme Court Holds That Lands and Terminals Can Be Valued at Present Prices

The railroads of the country won an important and far-reaching decision over the I. C. C. in the Supreme Court on March 8, 1920. The court held that in fixing a valuation of a common carrier the commission must follow the provisions of the act of Congress passed March 1, 1913, and consider the present cost of condemnation and damages, or of purchase in excess of original cost or present value of all lands, terminals and rights-of-way owned or used by the railways in their business.

The suit was brought by the Kansas City Southern Railway to compel the commission, which was ascertaining its valuation in accordance with the March 1, 1913, amendment to the Act to Regulate Commerce, to hear proof "that its refusal to investigate and find such present cost of condemnations and damages or of purchase in excess of original cost or present value would result in great wrong and injury to the relator and in the aggregate would result in a finding with respect to said lands at least $5,000,000 less than the value so directed by the Act of Congress."

The commission declined to do this because such a plan seemed to be in conflict with the ruling of the Supreme Court laid down in the Minnesota Rate Case, but the Supreme Court held that this was an erroneous view to take. Continuing, it said:

> It is impossible to conceive how the Minnesota rate ruling could furnish ground for refusing to carry out the commands of Congress, the cogency of which consideration is made particularly manifest when it is borne in mind that the Minnesota rate cases were decided prior to the passage of the act in question.
>
> Finally, even if it be further conceded that the subject matter of the valuations in question which the Act of Congress expressly directed to be made necessarily opened a wide range of proof and called for the exercise of close scrutiny and of scrupulous analysis in its consideration and application, such assumption, we are of opinion, affords no basis for refusing to enforce the Act of Congress. * * *
>
> The judgment of the Court of Appeals is therefore reversed with directions to reverse that of the Supreme Court and direct the Supreme Court to grant a writ of mandamus in conformity with this opinion.

News Notes

Strike in Sioux City.—Employees of the power plant at the Sioux City (Ia.) Service Company walked out on March 4, tying up railway traffic and cutting off light service.

Industrial Relations Court Proposed.—The creation of a state court of industrial relations with broad powers to prevent strikes and lockouts and to insure "efficient and continuous" operation of all industries of public interest and of public utilities and common carriers is provided in a bill introduced by Chairman Knight of Senate labor and industries committee in New Jersey.

Committee Approves Cleveland Subway.—The street railway committee of the City Council of Cleveland, Ohio, has approved the issuance of $15,000,000 of bonds for the construction of a municipal subway. It has also approved the proposition to lease the subway to the Cleveland Railway. The proposals will be submitted to a referendum vote on April 27, if accepted by the City Council.

Home Rule Act in Kentucky.—A home-rule bill has been introduced in the Kentucky House. It has been ordered printed and referred to the committee on rules. The measure provides that "any city or town in the Commonwealth of Kentucky shall have the right by ordinance to regulate the service, and to fix and regulate the rates, tolls, and charges of water, light, gas, electric light, power and heat, telephone and street railway service to users, consumers and customers."

Binghamton Men Strike. — Because the Common Council of Binghamton, N. Y., failed on March 8 to adopt an ordinance permitting an increase in fares to 6 cents the employees of the Binghamton Railway struck on March 9 and the system is completely tied up. The men said their action was not against the railway, which had promised them a raise in pay if they got the increased fare, but against five Aldermen who voted against the ordinance. New compromise ordinances have been introduced.

Preparing New Scale at Wheeling.—To prepare a new annual wage scale to be presented to the electric railway officials of the entire Wheeling district to become effective on May 1, an all-day session of representatives of the various crafts affiliated with the union was held on Feb. 23. The session was attended by thirty-five representatives from all the lines in Wheeling, eastern Ohio and as far up the river as Weirton. It is stated that the new wage scale will be completed and ready for presentation by April 1.

Programs of Meetings

New England Street Railway Club

The twentieth annual banquet of the New England Street Railway Club will be held at the Copley Plaza Hotel, Boston, Mass., on March 25 at 6:30 p.m. The annual meeting for the election of officers will be held at 3 p.m. the same day.

The New England Street Railway Club has always been honored at its annual banquets with speakers of great national prominence. The speakers at the coming meeting will be William C. Sproul, Governor of Pennsylvania; Calvin Coolidge, Governor of Massachusetts; Andrew J. Peters, Mayor of Boston, and Matthew C. Brush, president of the American International Ship Building Corporation.

Second Railroad Conference

The second annual railroad conference of the American Association of Engineers will be held in the Congress Hotel, Chicago, on March 15. Among the speakers and subjects are:

"Plans for A. A. E.'s Future Railroad Work," by G. W. Hand, chief engineer of the Northwestern Railway. Discussion by J. B. Jenkins, valuation engineer of the Baltimore & Ohio and F. E. Morrow, chief engineer of the Chicago & Western Indiana.

"A. A. E. Railroad Salary Schedule," by W. C. Bolin of the association railroad committee. Discussion by R. W. Barnes, principal assistant engineer of the Southern Pacific, C. F. Bower, president of the Burlington Lines East Railroad Section, A. M. Knowles, president of the Erie Railroad Section, O. R. West, president of the Santa Fe Coast Lines Section.

"Railroad Sections: Their Organization and Function." The speaker is not selected.

"Railroad Sections: Their Relation to the Railroad Management," by F. C. Huffman, president of the Chicago & Northwestern Railroad Section.

"Railroad Sections: Their Relation to the Chapters," by Paul Augustinus, past president of the Chicago Chapter.

These subjects will be presented at the afternoon session, of which J. R. Leighty, chief engineer of the Missouri Pacific, will be chairman. The morning session will be in charge of W. W. K. Sparrow, assistant chief engineer of the Milwaukee. It will be devoted to registration, reports, and a résumé of the work of the association during 1919.

At the evening session W. H. Hoyt, chief engineer of the Duluth, Missabe & Northern Railroad, will preside. Dr. F. H. Newell, president of the association, will speak on the "American Association of Engineers—Its Aims and Ideals." Other speakers at the evening session will be Arthur S. Tuttle, chairman, Bion J. Arnold and Oscar C. Merrill.

S. M. Felton, president of the Chicago Great Western Railroad, will also speak at the evening session. His subject will be "Problems of the Railroads Since Their Return to Private Control."

Financial and Corporate

Drastic Reorganization

Stockholders of Another Interurban Wiped Out Entirely in Reorganization

The Kansas City-Western Railway, operating between Kansas City, Mo., and Leavenworth, Kan., and in Leavenworth, was sold at auction on Feb. 16, for $250,000. As noted previously in the ELECTRIC RAILWAY JOURNAL, the property was purchased by Walton H. Holmes, president of the Pioneer Trust Company, Kansas City, Mo., representing a committee of bondholders.

SALE FOLLOWED FORECLOSURE

The sale was the result of a foreclosure suit brought in the Federal Court in Kansas by the Guaranty Trust Company, New York, N. Y., trustee for the holders of $1,600,000, par value, of bonds. The committee which purchased the road included Walton H. Holmes, P. W. Goebel, president of the Commercial National Bank, Kansas City, Kan., and P. T. White, Cleveland, Ohio. The committee headed by Mr. Holmes succeeded in having a large number of claims for damages declared junior to the lien of the bondholders by the Federal Court and also avoided a receivership.

The original plan and agreement for the reorganization of the company was dated April 1, 1919. This was subsequently modified because conditions changed and made the operation of the line more and more difficult. The amended plan is dated Feb. 16. Depositing bondholders who do not desire to approve the amendment have the right to withdraw their bonds and assessments, less their pro rata share of expense incurred to date by the reorganization committee and receive their share of the distributable proceeds from the sale of the property. Such non-depositing bondholders will receive about $110.74 for each $1,000 bond and coupons attached.

REASONS FOR MODIFYING PLAN

It is pointed out that the gross earnings of the property for the calendar year ended Dec. 31, 1919, were $407,804, the largest in the history of the company. The operating expenses, including maintenance, were $396,866, almost the largest in the history of the company. It was feared, however, that if the plan of April 1, 1919, was carried out another reorganization would be necessary in the near future, as the burdens upon the earning capacity of the property would be too severe to provide for the interest of 6 per cent upon the new first mortgage bonds.

The original plan of reorganization provided for the authorization of $1,000,000 of first mortgage 6 per cent bonds, $500,000 of preferred stock and $500,000 of common stock. It was proposed to issue under this plan $958,800 of first mortgage bonds, $479,400 of preferred stock, and 479,400 of common stock. There was previously outstanding $42,000 of Kansas City-Leavenworth Railroad 5 per cent first mortgage gold bonds due Sept. 1, 1919; $1,598,000 of Kansas City-Western Railway first mortgage 5 per cent twenty-year gold bonds; $42,000 of bonds to retire the Kansas City-Leavenworth first mortgage gold bonds and $10,000 of bonds in the treasury of the company, making the total outstanding bonds, $1,650,000. There was also outstanding capital stock to the amount of $2,000,000.

It is explained that the property upon confirmation of the sale by the court will belong to the depositing bondholders represented by $1,558,000 par value of bonds, the assessment paid upon which is intact. If the amended plan is approved the money so deposited will be used to pay the estimated expense of foreclosure and reorganization placed at $116,151. The amendments proposed to the original plan of April 1, 1919, are as follows:

1. Reduce the interest on the new bonds from 6 per cent per annum to 5 per cent per annum.
2. Date new mortgage as of April 1, 1920, or as soon thereafter as the sale is approved by the court.
3. Issue preferred stock at par equal to interest include March 1, 1920, instead of March 1, 1919, on bonds surrendered.
4. Authorize $1,250,000 of bonds, $625,000 of preferred stock, and $625,000 of common stock.

None of the securities in excess of the amounts provided in the plan of April 1, 1919, is to be issued at this time, except the necessary preferred stock to provide for the accrued interest on bonds surrendered.

It is expected that the court will defer confirmation of the sale until a satisfactory plan is determined upon.

Offers Road to City

George A. Stanley, president of the New York & North Shore Traction Company, operating from Flushing to Whitestone, and to Hicksville in Nassau County, Long Island has offered his line to the city of New York as a gift, if the city will operate the road at a 5-cent fare. He made this proffer at a hearing before the Public Service Commission for the First District called to investigate the action of the company in ceasing service over all its lines. He stated that at many points the company's tracks were buried beneath several inches, and in some cases several feet, of ice, and that the company had no money with which to remove the encumbrances. He stated, however, that he was willing to resume service immediately after the snow had melted and the tracks were clear.

Harrisburg Expenses Jump

Passenger Traffic Increases 10 Per Cent —Employees Get 97.7 Per Cent More in Wages Than Before the War

The report for the year 1919 of the Harrisburg (Pa.) Railways states that 3,795,574 car miles were operated, and that the total number of passengers including cash and transfers was 31,572,762. The total number of passengers carried shows an increase over 1918 of 1,640,544.

COSTS JUMP, TOO

With the increase in the number of passengers, the cost of operation likewise increased. During 1918 the cost of operation amounted to $747,396 while in 1919, the cost was $989,267, equivalent to 32.3 per cent increase. This increase was due to higher wages allowed carmen and other employees during the year, and the increased costs of practically everything pertaining to the railway system. Since the beginning of the war, the wages of the employees of the company have been increased 97.7 per cent.

FARES INCREASED

On Oct. 1, 1918, the 6-cent fare went into effect. Since then wage increases have been allowed that amount to 7 cents per hour. This increase represents a raise of approximately 20 per cent during the period. It has eaten up most of the revenue derived from the increase in fare.

Another important item of expense is taxes, for the Harrisburg Company pays, perhaps, more than any other railwny operating in any city of the third class in Pennsylvania. During the past year $130,000 was necessary, $39,000 of which went into the coffers of the Harrisburg city treasury under the provisions of the franchise.

IMPROVEMENT PLANS

The company during the coming spring and summer contemplates making many improvements that should have been made in the past. Among these it will build the extension on Herr Street from Seventh Street to Eighteen-and-a-half Street with the hope of being able to render better service to a rapidly growing section of East Harrisburg. Changes are also contemplated at the power house and carhouse due to the rapidly increasing load and the number of cars operated. At the present time, the company owns 133 cars, 110 of which are of the closed type, and twenty-three are open cars.

New Louisville Director

L. W. Botts, president of the Fidelity & Columbia Trust Company, and connected with the Louisville, Henderson & St. Louis Railroad, controlled by the Louisville & Nashville Railroad, has been elected a member of the board of directors of the Louisville Railway, making the fourteenth member, of the fifteen agreed upon. Mr. Botts was formerly a director of the company.

Duluth Operates At a Loss

Increased Expenses Eat Up Gain in Gross—Surplus 10 Per Cent Less Than Last Year

The annual report of the Duluth-Superior Traction Company, Duluth, Minn., for the year 1919 shows that the cost of rendering service increased more during the past year than the gain in revenues. As a result the net income transferred to profit and loss at the end of the year was 12 per cent less than in 1918.

The gross revenues showed an increase of $272,951 or 16.22 per cent over the previous year and an increase of $315,049 or 19.15 per cent over the year 1917. The net income transferred to profit and loss for the year showed a decrease of $14,288 or 12 per cent as compared with the year 1918 and a decrease of $181,029 or 63.34 per cent as compared with the year 1917.

The increase in operating expenses was attributed to the continued high cost of materials and supplies used in the maintenance and operation of the property, and also to the two wage increases to the employees. The inability of the company to meet its increasing costs with a continual decreasing net revenue made it necessary to seek additional revenue; especially after the citizens in Duluth on April, 1919, had voted against municipal ownership.

In anticipation of the necessity of obtaining increased revenue the company on Sept. 1, 1919, started an appraisal of the property and on Dec. 4, 1919 renewed its efforts with the city of Duluth to obtain an increase in the unit rate of fare. Similar application is also pending before the Wisconsin Railroad Commission. Hearings have not yet begun, pending the completion of the valuation.

An analysis of the accompanying table shows that passenger traffic increased more than 15 per cent with a corresponding increase of 16.27 per cent in passenger revenues. Operating expenses as a whole including depreciation based on the 4 per cent sinking fund method increased 21.57 per cent. The equipment and conducting transportation accounts show the greatest increase—these being 37.95 and 28.95 per cent respectively. The operating ratio increased from 77.7 in 1918 to 81.35 in 1919 or 3.65 per cent. Taxes increased $10,288 or 10.79 per cent notwithstanding the fact that the tax per $100 of gross revenue decreased 26 cents.

STATEMENT OF EARNINGS OF DULUTH-SUPERIOR TRACTION COMPANY

	1919	1918	Per Cent Change + Increase — Decrease
Revenue from transportation	$1,925,726	$1,656,139	+16.27
Revenue from other railway operations	11,417	9,770	+16.83
Total railway operating revenues	$1,937,143	$1,665,909	+16.29
Way and structures	$202,978	$183,496	+10.62
Equipment	213,235	154,617	+37.95
Power	205,432	197,226	+ 4.16
Conducting transportation	735,381	570,390	+28.95
Traffic	1,338	1,488	—10.08
General and miscellaneous	216,472	187,462	+15.48
Transportation for investment—Cr.	*1,722	* 997	+72.70
Total railway operating expenses	$1,573,114	$1,293,682	+21.57
Net operating revenue	$364,029	$372,227	— 2.20
Taxes assignable to railway operation	105,683	95,395	+10.79
Operating income	258,346	276,832	— 6.67
Non-operating income	22,293	20,575	+ 8.35
Gross income	$280,639	$297,407	— 5.64
Interest on funded debt	174,838	175,002	— 0.09
Interest on unfunded debt	110	1,015	—89.20
Miscellaneous debits	923	2,333	—60.50
Total deductions from gross income	$175,871	$178,350	— 1.40
Net income transferred to profit and loss	$104,768	$119,057	—12.00

* Deficit.

STATISTICAL STATEMENT OF THE DULUTH-SUPERIOR TRACTION COMPANY

	1919	1918	Per Cent Change + Increase — Decrease
Gross revenue	$ 959,436	$1,686,485	+16.22
Revenue passengers	38,475,440	33,088,747	+16.25
Transfer passengers	6,408,086	5,728,778	+11.85
Total passengers	44,883,526	38,817,525	+15.64
Mileage—first main track	57.04	57.04	.....
Total miles—all track	104.09	103.75	+ 0.34
Revenue from transportation—Per mile of line	$33,761	$29,000	+16.42
Per mile of single track	$18,515	$15,950	+16.10
Passenger traffic—Per mile of line	785,000	682,000	+14.80
Per mile of single track	448,000	374,200	+19.75
Operating ratio (per cent)	81.35	77.70	.....
Per cent on $1,500,000 preferred stock earned and paid	4.00	4.00	.....
Per cent on $3,500,000 common stock earned	1.28	1.68	—0.40
Taxes per cent of gross revenue	5.40	5.66	—0.26

Vancouver Pays Dividend

Difference in Exchange Rate Enables Common Stockholders to Benefit by a Bonus

The annual report for the year ended June 30, 1919, of the British Columbia Electric Railway, Ltd., recently issued indicates that notwithstanding the serious twenty-four day strike of June, 1919, the company was able to maintain its dividend payments. This was not due entirely to actual earnings, but to the unusual existing profit on exchange in remitting moneys from Vancouver to London and the appropriation of certain monies held for contingencies, which, under the altered conditions, the directors considered were no longer needed. This amounted in all to £138,419.

The net income transferred to profit and loss from operation during the year amounted to £391,763. The profit from exchange, and transfers of reserves no longer needed, registration fees, etc., made a total of £530,327. Adding the balance from the previous year, less a 5 per cent dividend of £72,000 for the year ended June 30, 1918, on the cumulative perpetual preference stock (really a bond issue) gives £6,085, thus making the total revenue £369,105.

Deductions were as follows—£154,727 for depreciation, equivalent to 3.1 per cent on the book value of the property; directors and trustee fees, office rent, salaries, etc., £12,581; leaving a balance of £369,105 for interest and dividends.

Interest on debentures and debenture stock for the year was £132,447. Dividends on the 5 per cent cumulative perpetual preference stock and an interim dividend of 2.5 per cent on the preferred ordinary stock paid during the year totalled £108,000. The balance therefore available for further distribution was £128,657. At the annual meeting, the directors voted the payment of a final dividend on the preferred ordinary stock of 2.5 per cent for the year ended June 30, 1919, a 3 per cent dividend and a 3 per cent bonus on the preferred ordinary stock, amounting in all to £122,400. The balance for the year therefore was £6,258.

Court Enters Decree of Sale

Judge Sater, sitting in the United States District Court at Cincinnati, Ohio, has entered a decree of foreclosure and sale of the property of the Springfield Terminal Railway & Power Company, Springfield, Ohio. The court has, however, given the company until March 31 to pay the principal of the $250,000 of first mortgage bonds and accrued interest. In the default of making such payments the receiver, George Whysall, is ordered to sell the property at public auction to the highest bidder at the County Court House in Springfield, Ohio, on a day to be named by Mr. Whysall. As the receiver must advertise the property before offering it, there is little likelihood that the sale will take place before early in May.

Louisville Deficit Increases

Expenses of Operation Exceed Revenues Without Depreciation Allowance or Dividend Payments

The Louisville (Ky.) Railway in its annual report to the stockholders for the year ended Dec. 31, 1919, compares present financial conditions with those existing in 1916—the year prior to the World War. This comparison shows that during this period expenses increased five times as fast as the revenues from operation.

Despite the strike of the trainmen operating revenue increased nearly $500,000. It is difficult to give in exact figures the cost of the strike. On the one hand, revenues were diminished. On the other, the expenses of operation were less. What the revenue would have been had there not been a strike, is purely an estimate. That the expenses were less comes from the fact that but few cars were operated a part of the time and not for a number of weeks were normal operations resumed. The best judgment places the net cost of the strike at $327,000. Even a gain of this amount in gross revenue would have been insufficient to pay a depreciation allowance of $85,000 and a 5 per cent dividend on the $3,500,000 outstanding cumulative preferred stock. A deficit of $90,505 would have existed at the end of 1919 without any dividend on the common stock having been paid.

INCOME STATEMENT OF LOUISVILLE RAILWAY

	1919	1916	Per Cent Change +Inc. −Dec.
Railway operating revenue	$3,537,234	$3,078,296	+14.92
Railway operating expenses	2,794,439	1,561,580	+72.60
Net operating revenue	742,795	1,516,716	−51.00
Taxes assignable to railway operation	366,000	315,051	+16.15
Operating income	376,795	1,201,665	−68.60
Other income (a)	105,297	182,000	−42.70
Gross income	482,092	1,383,665	−65.10
Interest on bonds and discount on notes sold	639,597	621,750	+28.70
Net income	*157,505	761,750	.....
Dividends	None	670,650	.....
Surplus	*157,505	91,265	.....
Depreciation (not paid in 1919)	.....	85,000	.....
Balance	*157,505	6,265	.....
			Increase
Taxes—per cent of gross revenue	79.10	50.80	29.70
Operating ratio (per cent)	13.50	10.25	2.25

* Deficit. (a) Louisville Interurban net earnings in this item.

LOUISVILLE RAILWAY QUOTATIONS

Jan. 1	1920	1917	Loss	Per Cent Decrease
Common stock	25	96	71	74.0
Preferred stock	50	101	51	50.5
First mortgage bonds (5%)	83	103	20	19.4
Second mortgage bonds (4.5%)	64	92	38	41.4
Consolidated mortgage bonds	65	99	34	34.4

One of the outstanding reasons for this deficit is the fact that since 1916 the compensation to employees has increased 87.5 per cent and taxes 16.15 per cent.

In order properly to provide for deferred maintenance, pay the 5 per cent dividend on the preferred stock and a 6 per cent return on the common stock it is obvious that the railway operating revenue must be increased by at least 20 per cent without making a further allowance for wage increases. This actually calls for an increase in the net operating revenue of 100 per cent.

A table is presented showing the effect of public opinion on the increased expenses of the company as reflected by the value of its securities.

$341,000 of Bonds Authorized

The Public Utilities Commission of the District of Columbia has ruled favorably on the application of the Washington Railway & Electric Company for permission to issue $341,000 of general mortgage 6 per cent gold bonds. The commission has, however, carefully laid down the conditions of the issue, it being of the opinion that the expenditures indicated in Schedule "B," amended, were not in whole or in part reasonably chargeable to operating expenses or income.

On Sept. 26, 1919, the company renewed its application to the commission for a certificate of authority to issue and sell general mortgage 6 per cent gold bonds to the amount of $341,000, face value, dated Dec. 2, 1918, payable on Dec. 1, 1923, the proceeds of the sale to be used to reimburse the company's current funds for the balance of the capital expenditures made from Jan. 1, 1909, to Jan. 31, 1915.

In its order the commission said:

> The valuation of the company's property has been completed and the opinions and findings of the commission were announced on Sept. 4, 1919. From the information now before it, the commission is of the opinion that the money to be procured by the sale of the said bonds of the Washington Railway & Electric Company to the amount of $341,000 is necessary to, and reasonably required by, the said company for reimbursement of funds heretofore expended for the purposes indicated in its Schedule "B," excluding therefrom those items enumerated as covered by bonds issued under authority of the commision's order number 143.

Bond Extension Asked

The Maumee Valley Railways & Light Company has asked holders of the $300,000 of first mortgage 5 per cent gold bonds of the old Toledo & Maumee Valley Railway which matured on March 1, 1920, to consent to an extension of the maturity date for one year. Frank R. Coates, president, addressed a letter to all bondholders in which he offers to increase the interest rate to 5½ per cent for the period of extension.

The franchises of the company expired in June and September, 1919, and the company, which was operating at a deficit, has been released from rate restrictions and some other conditions unfavorable for profitable operation of the line.

The Doherty interests took over the road in 1913 and it has shown the following net results: 1913, $6,972; 1914, $6,486; 1915, $10,329; 1916, $11,690; 1917, $2,836; 1918, deficit, $9,156; and 1919, deficit, $28,199.

Passenger rates have been increased and unprofitable freight business has been abandoned, but the management has not had sufficient time to determine the effects of the new conditions, it is announced.

Interurban Earnings Increase

The annual report of Edward Goepper, president of the Toledo, Bowling Green & Southern Traction Company, to the stockholders at their meeting at Findlay, Ohio, on Feb. 24, showed an increase in gross receipts of 11.5 per cent over the previous year, while operating expenses were 18.33 per cent less.

The suspension of car service within the city limits of Toledo by the working of the "ouster ordinance" approved by the people last November caused a loss of $15,000, the president's report indicated.

Injuries to passengers in accidents cost the company $15,175. The most costly accident was a collision of a Clover Leaf Railroad train and a traction car at a crossing south of Toledo on March 10, 1919. This accident alone cost the company $8,873.

Receiver for White Plains Line

Leverett S. Miller on Feb. 28 was appointed by Supreme Court Justice Joseph Morschauser as receiver for the Westchester Street Railroad, White Plains, N. Y. Mr. Miller is the present manager of the railway. Justice Morschauser, acted on complaint of the Farmers Loan & Trust Company, New York, which seeks to foreclose a mortgage of $168,000. The court granted a motion for a receiver in order that the road may be kept running and the public may not be inconvenienced.

The Westchester Street Railroad is controlled by the New York, New Haven & Hartford Railroad and is operated by the same management as the New York, Westchester & Boston Railway. The company owns 22.50 miles of track and operates 7.63 miles additional under trackage rights, making 30.13 miles in all. It leases and operates the Shore Line Electric Railroad, a system with 1.46 miles of track. The Westchester Company has outstanding $700,000 of capital stock and $386,000 of bonds. The Shore Line has outstanding $50,000 of capital stock and $23,737 of bonds. The total capital liabilities of the two companies are therefore $1,159,737.

Losing $2,525 a Day

Frank Samuelson, auditor for the receiver of the New York (N. Y.) Railways, testifying recently before the Board of Estimate, said that operations for January showed a deficit of $78,293. The company is losing on an average $2,525 a day in operation. It lost during recent snow tieup $675,000 in receipts, and the cost of snow removal, with only part of the bills in, was $207,000, making total for February storm of $882,000. Mr. Samuelson admitted that the company had reserve for maintenance and depreciation from $1,700,000 to $1,800,000 under the order of the court to set aside 38 per cent, but defended the necessity for accumulating this amount on the ground repairs come in cycles and it would be impossible to make necessary provision from earnings of any one year.

Henry L. Stimson showed that the gross receipts of the company since reorganization have been stationary or decreasing. Gross receipts for the year ended June 30, 1913, were $13,605,852; for 1915, $13,010,932; for 1917, $11,195,729, and for 1919, $11,606,853. He said that the saturation point in receipts of company has been reached and the only remedy is an increase in fare.

While the total underlying mortgages of the subsidiary companies is only $21,450,000, the assessed valuation of the land and buildings now under control of the receiver is placed by the city at $19,408,000, and the valuation of the property in the streets including conduits is placed by state assessment at $19,551,900.

Traffic Increases in Atlanta

The 1919 annual report of the Georgia Railway & Power Company, Atlanta, Ga., indicates that the passenger traffic exceeded that of the previous year by nearly 10 per cent notwithstanding fares were increased 20 per cent in April, 1919, except on two lines, due to contracts the fare is limited to 5 cents.

For the three months ended March 31, 1919, before the rate of fare was changed the increase in the number of passengers carried over the corresponding period of 1918 was 7.75 per cent. For the nine months covering the balance of the year, during which time with the exception of first two weeks in April, the 6-cent fare was in effect, the increase in passengers carried was 10.2 per cent over the corresponding period of the previous year.

This gain would indicate that the increase in fare did not have any deterrent effect on the passenger traffic. A part of this, however, may be attributed to the growth of the territory served, for the population inside the corporate limits of the city of Atlanta has increased from 154,000 in 1910 to at least 225,000 and that it is now generally conceded to be the financial, commercial and railway center of the South. The real population served by the 248.14 miles of track forming the electric railway system, which covers more than merely the corporate Atlanta limits, is estimated to be 250,000.

The mention of the traffic details was made in our issue of Feb. 7.

North American Company to Reduce Stock

A special meeting of the stockholders of The North American Company will be held March 17 for the purpose of (1) acting upon the proposition to amend, alter and change the certificate of organization so as to increase the authorized capital stock of the company from $30,000,000, its present authorized capital stock, to $43,750,000, consisting of 500,000 shares of 6 per cent cumulative preferred stock of the par value of $50 each, and 750,000 shares of common stock of the par value of $25 each and (2) acting upon the proposition to decrease the issued capital stock of the company from $29,793,300, the amount now issued and outstanding, to $22,344,975, such decrease to be effected by reducing the par value of the shares now outstanding, viz., $100 each, to $75, to consist of one share of 6 per cent cumulative preferred stock of the par value of $50 and one share of common stock of the par value of $25.

Increase in Net for Holding Company

Earnings of the American Light & Traction Company, New York, for the year ended Dec. 31, 1919, on stocks of subsidiary companies owned were $3,355,055 as against $3,732,941 in 1918, a decrease 10.12 per cent. Miscellaneous earnings totaled $1,006,490, an increase of 69.7 per cent. Gross earnings equaled $4,361,546 as against $4,326,367 in 1918. Deducting expenses, which were $218,683, or 29.8 per cent less than in the previous year, the net earnings were $4,142,863 compared with $4,014,801 in 1918. Adding surplus and reserve of $11,869,329 for 1918, the total surplus earnings applicable to dividends were $16,012,192, as against $17,104,281 in 1918, a decrease of 5.86 per cent.

During the year 35.5 per cent of the surplus was paid out in two cash and one stock dividends amounting in all to $5,689,447. The surplus balance for the year was $10,324,745 a decrease of 13 per cent.

Service-at-Cost Commission

Appointment of a committee of three to draw up for Tacoma, Wash., a service-at-cost plan has been completed by the naming of F. H. Rudkin, United States District Judge at Spokane, who makes the third member of the commission. The city has appointed one man and the railway one. The three will draw up a new franchise embodying the Cleveland idea and establishing, it is believed, a sliding scale of fares. It is planned to submit the franchise to the voters at the April election.

Financial News Notes

Purchase at Gadsden Approved.—The Alabama Public Service Commission sitting at Montgomery has approved the transfer of the electric and the railway properties at Gadsden to the Alabama Power Company. The companies taken over are the Alabama City, Gadsden & Attalla Railway and the Gadsden Railway. The proposed transfer of the properties was referred to in the ELECTRIC RAILWAY JOURNAL for Feb. 7, page 307.

Business Men Save Railway.—Electric railway service was saved for Eureka on Feb. 28 by the business men of the city, who raised a fund of $2,443 to pay the 5¼ per cent State tax on the annual gross earnings of the Humboldt Traction Company, which the company had announced it was unable to pay. Manager J. W. Hale had announced that service would have to be discontinued unless some one came to the rescue of the company, as the security holders had declined to pay the State tax, or spend any further money on the road.

Directs Study of Reorganization Plan.—A bill has been introduced into the Legislature of Rhode Island directing the Public Utilities Commission to investigate the plan for the reorganization of the Rhode Island Company as advanced by the receivers and also to inquire into any other plan that may be offered for reorganizing the company. The bill requires the commission to report not later than March 23. The receivers have suggested State ownership and control for the company with private operation. Their plan was referred to at length in the ELECTRIC RAILWAY JOURNAL for Feb. 28, page 445.

Kansas City Railways Doing Better. — Philip J. Kealy, president of the Kansas City (Mo.) Railways, points out that during the month of January the system cleared approximately $51,000 above operating expenses, and that the February figure will be greater. In an agreement with the bondholders' protective committee the company is discounting bonds and interest on notes for this year, which at the end of the year will total nearly $2,000,000. Mr. Kealy referred to the 1919 situation, declaring that the company lacked nearly $750,000 of meeting expenses of operation.

First Profit for Municipal Line.—For the first time since it was placed in operation, the Tacoma (Wash.) Municipal Railway, connecting the city with the shipyards and other industrial plants, is said to have operated at a profit in the month of January. A balance of $1,839.23 was left after charging off a depreciation of $2,000.

The net passenger revenues for January were $12,418 with switching revenues of $1,600. It is said the reason for the profit is the establishment of a loading station at the shipyard end of the line, making possible the collection of all fares.

A Loss That Became a Gain.—The municipally owned electric railway between Attleboro and Briggs Corner, Mass., showed a deficit in its first year of operation of $383.54, according to figures made public by Harry J. Goodale, superintendent of public works, who manages the road. The total operating receipts were $17,485.47 and the total operating expenses were $17,873.54. A 7-cent fare is charged. The city considers the road a success inasmuch as practically $2,000 extra was obtained by the city treasury because of the increased valuation on property abutting the road.

Change in Name.—The name of the Mahoning & Shenango Railway & Light Company, operating electric power and light and city and interurban railways in Mahoning and Trumbull Counties, Ohio, and Lawrence, Mercer and Beaver Counties, Pa., with main offices in Youngstown, Ohio, has been changed by the stockholders to The Pennsylvania-Ohio Electric Company. The change in name in no way affects the property, ownership or management. It has been made because the activities of the company have outgrown the old name and the new name is better descriptive of the territory served and the services rendered.

Receiver Must Fix Scrap Value.—At the Federal Court at Cleveland, Ohio, on Feb. 14, C. G. Taylor, receiver of the Sandusky, Norwalk & Mansfield Electric Railway, was given three weeks in which to appraise the scrap value of the system, which is roughly estimated at $175,000. This action was taken in behalf of the majority bondholders who desire to scrap the road. The court, it is stated, has taken steps to give the minority bondholders the privilege of buying in the property. The receiver has jurisdiction over 25.6 miles of track between Norwalk and Plymouth and 6.9 miles between Plymouth and Shelby. It is stated that only the northern division is involved in the courts.

Tacoma Traffic Increasing.—An increase of 19 per cent in the total number of passengers hauled in January, 1920, and 22 per cent increase in the number of revenue passengers over the same month in 1918, is reported by the Washington Water Power Company, Spokane, Wash., to Mayor Fleming in the monthly statement as to railway operations. No comparison with January, 1919, was made because of the existence of influenza last year, which sent traffic totals below normal. Expenses, exclusive of taxes, also show an increase of 19 per cent over January, 1918. Taxes increased 35 per cent, while the pay received by the street railway employees advanced only 29 per cent.

$89,000 of Bonds Authorized.—The Indiana Public Service Commission has authorized the Interstate Public Service Company, Indianapolis, Ind., to issue and sell at not less than 80 per cent of par $89,000 of first and refunding mortgage thirty-year 5 per cent gold bonds to reimburse its treasury for 75 per cent of the cost of additions, improvements and extensions. The Interstate Public Service Company has also been authorized to buy from Martin J. Insull all the capital stock, $150,000 common and $50,000 preferred, and $89,821 of promissory notes of the Indiana Public Service Company for $110,000, such sums to be paid in serial, promissory notes at 6 per cent interest, due in from three to sixty months.

Southern Road Needs Help.—Joseph K. Choate, vice-president of the Augusta-Aiken Railway & Electric Company, Augusta, Ga., at a recent rate hearing before the Georgia Railroad Commission made plain the perilous financial condition of the company. Mr. Choate explained that the railway had obtained a loan of $140,000 through the operating managers of the company, the J. G. White Management Corporation. He said that the affairs of the railway were critical. It needed help instead of adverse criticism and suspicion. This help must come quickly to avoid bankruptcy—to the general detriment of the service and the probable dismantlement of the property of the company.

City Permits Discontinuance.—The city of Davenport, Ia., is planning to order the discontinuance of the Fourth Street line of the Tri-City Railway and to turn approximately 1 mile of the street traversed by this line into a boulevard. The company has for several years urged the discontinuance of the line as it parallels two other lines and has been losing at the rate of $10,000 annually. The company stopped service on this line last year, but was compelled to resume state operation in order to secure a 7-cent fare. The city authorities have now come to realize that the company should be no longer burdened by operating a consistent money-losing line. The city's recent action was taken independently of company suggestion.

Valuation Under Way in Richmond.—Stone & Webster have been engaged by the Richmond Railway & Power Company, Richmond, Va., to make a complete inventory and appraisal of the property of the company in Richmond. It is estimated that the work will be completed in three months' time. The valuation is being made for the purpose of establishing a basis for determining a rate of fare which will enable the company to produce a fair return on the fair valuation. Before beginning the work, Thomas S. Wheelwright, president, extended an invitation to the State Corporation Commission and to the City Council to designate representatives to co-operate with the engineers in order to arrive at a valuation acceptable both to the company and to the public.

Abandonment of Service Proposed.—The board of trustees of the Eastern Massachusetts Street Railway, Boston, Mass., has announced that service will be indefinitely suspended on the Hyde Park Lines unless the municipalities served render financial assistance in the operating expenses. The result of such an act will deprive the communities of Hyde Park, Mattapan, Dedham, Readville, East Walpole, Norwood and Westwood of service and reduce the mileage of the system about 20 miles. The suspension of service will take effect on April 1 unless the relief asked for is forthcoming. The company has announced that owing to the shortage of cars and the conditions of tracks owing to the severity of storms prevalent in this section this winter, service will be indefinitely suspended on the Reading-Lowell, Reading-Lawrence, Woburn-Lowell and the North Reading-North Reading Junction lines.

Rental Payments on Account—By a decree entered on March 2 in the Superior Court by Presiding Justice Tanner, the receivers of the Rhode Island Company, Providence, R. I., are directed to pay $250,000 to Cornelius S. Sweetland, receiver of the United Traction Company. In explanation of this decree, Eugene A. Kingman, who petitioned the court, stated that the decree authorized the payment of $250,000, on account, to Mr. Sweetland, on behalf of the United Traction Company, toward the rental price that the receivers of the Rhode Island Company may be called upon to pay for the use of the Union, Pawtucket and Suburban Railroad systems. In April last, the leases of these three systems to the Rhode Island terminated, and the receivers have since operated these roads. The matter of the rent to be paid by the receivers for the use of these systems is now pending before Richard E. Lyman as master, who will determine the total price at a later date. The $250,000 payment authorized by the decree is simply a partial payment, the exact wording being "on account."

Puget Sound Will Issue Preferred Stock and Change Its Name.—It is proposed to change the name of the Puget Sound Traction, Light & Power Company, Seattle, Wash., to the Puget Sound Power & Light Company. The company some time ago sold its railway lines in Seattle to the city. At the time the name is changed a proposal will be voted upon to authorize $10,000,000 of 7 per cent cumulative prior preferred stock, issuable from time to time as may be desirable. Since the refunding of the short-term notes in June, 1918, it has been necessary to spend considerable sums on the power system and the directors believe it would be highly undesirable if not impossible to finance all of the requirements by further increases in the funded debt. They feel that the sale of stock not only will make it possible to maintain a more conservative balance between the debt and the capital stock, but also will enable permanent borrowing on a more economical basis if it appears wise to resort to such borrowings.

Traffic and Transportation

Asks Enabling Legislation

Vancouver Company Would Come Under Jurisdiction of Provincial Commission—Inquiry Held Up

It is expected that amending legislation will be passed this spring which will again place the British Columbia Electric Railway under the jurisdiction of the Public Utilities Commission of British Columbia. The company has joined in the petition that this be done. When this has been done it is expected that the investigation will be resumed which was commenced by Commissioner Retallack some time ago to ascertain the fare to be charged in the city of Vancouver and that an appraisal will be made of the property of the company on the mainland.

Fare Inquiry Dropped

The investigation by the commissioner into the matter of fares in Vancouver was adjourned temporarily owing to peculiar circumstances. In Vancouver the company is charging a 6-cent fare. This rate was provided by the City Council in July, 1918, authorizing this charge for a period of nine months. The act creating the commission was passed before this period expired. It provided, however, for the continuance of the 6-cent fare, subject to the company being able to satisfy the commission that this rate was just.

The act also provided that until such proof was furnished to the satisfaction of the commission the amount received by the company in excess of the 5-cent fare previously charged should be deposited in a special account in a chartered bank in Vancouver, and that if the rate should be fixed at less than 6 cents the excess amount be handed over to the Vancouver General Hospital.

Commission Loses Jurisdiction

Owing to an amendment to the general railway act of Canada the railways of the company passed from the jurisdiction of the Province of British Columbia and of the Public Utilities Commission to that of the Dominion of Canada and of the Dominion Railway Board. This, of course, negatived the inquiry by the local authorities. As stated previously it is now hoped that amending legislation will result in the return of the company to the jurisdiction of the officials of the province.

Lynn Jitneys Given More Time

The City Council of Lynn, Mass., has extended to April 26 the time limit for the operation of jitneys within the city limits. By action of the Council, the licenses of the forty-two Lynn jitney drivers will expire on that date. The Council had previously set March 1 as the date for the expiration of the licenses. The Eastern Massachusetts Street Railway had asked that jitney competition be stopped, so that it could give Lynn adequate service at reduced rates. This action was taken in accordance with its policy of demanding that the communities which it serves choose between the railway and the buses as means of transportation.

Legislation Introduced at Albany

Among the bills introduced recently at Albany are the following:

Senate Intro. No. 506, Print No. 540, Introduced February 17th by Mr. Karle. Adding new section 54-a Railroad Law, by providing that a steam or electric railroad having a franchise in this state operting to and from stations in New York city and owned or operated by a railroad having a franchise from another state shall not charge in such city a rate in excess of rate charged for similar service from such city to stations in adjacent state whether over its own tracks or under agreement with another railroad.

Senate Intro. No. 661, Print No. 678, Introduced Feb. 25, by Mr. Lusk. Amending Section 40 Public Service Commission Law, by providing that if after a hearing on complaint alleging violation of section 26, or upon consideration of facts admitted in writing by a carrier, the Public Service Commission shall determine that any party complainant is entitled to award of damages, the commission shall make an order directing carrier to pay such award.

Senate Intro. No. 695, Print No. 729, Introduced Feb. 26 by Mr. Lusk. Amending Section 161-d Labor Law, by providing that no female under eighteen instead of twenty-one years as at present shall be employed on any street, surface, electric, subway or elevated railroad.

Senate Intro. No. 698, Print No. 732, Introduced Feb. 26 by Mr. Thompson. Adding new Section 194-a Railroad Law, providing for a crew of at least one motorman or driver and one conductor on every street, surface or interurban railway and for one conductor on every trailer. Each separate violation is made a misdemeanor.

Senate Intro. No. 708, Print No. 742, Introduced Feb. 26 by Mr. Shackno. Adding new subdivision 5, Section 57 Railroad Law, prohibiting any railroad company owning or operating a steam or electric road through any of the boroughs of New York City from charging more than a single fare of 5 cents for carrying a passenger from any station in the city to any other station therein on any train scheduled to stop at such stations.

Senate Intro. No. 843, Print No. 922, Introduced March 4 by Mr. Fowler. Enacting the Municipal Utilities Law constituting Chapter 71 of the Consolidated Laws. On application of municipalities the Public Service Commission shall determine the fair value of any utility property subject to acquisition or estimate cost of establishing a municipal utility where it is proposed to be done wholly or partly by acquisition of other property or by new construction. The commission must take into consideration amount of capital honestly and prudently invested, present condition of property, its depreciation and adaptability for municipal utility purposes. The finding of the commission shall not constitute conclusive evidence of value.

Senator Thompson introduced a bill on March 9 to amend the railroad law as an aid to the financial difficulties of street railway companies. By its provisions the companies would only be obliged to pay for paving 6 in. outside the rails. At present, street railway companies are obliged to pay for paving 2 ft. outside the rails. Senator Thompson explained that the bill was introduced at the request of the officers of the New York Electric Railway Association.

Surface Lines Prodded

New York Body Thinks Depreciation Allowance of 38 Per Cent Too Large

The Board of Estimate and Apportionment of New York has temporarily concluded the inquiry into the rapid transit lines and turned its attention to the surface roads. A discussion of the financial condition of the New York Railways, which operates the "green car" lines, took up the March 10 session. Corporation Counsel William P. Burr, who is conducting the inquiry for the city, attacked the present financial methods of the company, chiefly those relating to the fixing of the rate of depreciation.

Reserve Fund Called Excessive

Mr. Burr declared that the allowance of 38 per cent of the passenger revenue as a reserve fund against maintenance and depreciation was excessive. This amount was awarded the company some time ago by Federal Judge Julius M. Mayer. The Corporation Counsel held that the reserve fund was too high to permit the company to realize any profit on its investment. He contended that if the company had adhered to the old reserve of approximately 20 per cent, allotted by the Public Service Commission in 1912, its books would show a surplus where they now show continual losses.

In reply to the Corporation Counsel's request that the statement made by Henry L. Stimson, counsel for the company, to the effect that the practice of maintaining a reserve of 38 per cent was a common one, be substantiated by testimony, Mr. Stimson called to the witness stand Frank Samuelson, auditor for the company. Asserting that the company had fallen short in adequate protection of the property to the extent of $1.394.000, Mr. Samuelson maintained that the 5-cent fare was at present totally inadequate to meet the operating expenses.

Colonel Stimson offered evidence to show that the lines now in the hands of Job E. Hedges, receiver for the company, had been reduced by order of the Federal Court to less than 100 miles of road from the original 150 miles, and that the lines are not now earning any interest on the investment. He said that the lines in control of Mr. Hedges had lost during February in revenue through inability to operate and cost of snow removal a sum amounting to between $800,000 and $900,000.

Fare Increase Suspended

The Public Service Commission of the State of Washington has suspended for a period of ninety days a schedule of rates of the Grays Harbor Railway & Light Company, Aberdeen, under which the company proposed to raise fares in Aberdeen, Hoquiam and Cosmopolis from 5 cents to 7 cents beginning Feb. 20. No increase was planned in the rate bewteen Hoquiam and Aberdeen.

Seven Cents in Nashville

The Tennessee Public Utilities Commission in an order issued on March 3 authorized the Nashville Railway & Light Company to charge 7-cent cash fares. The commission ordered the sale of four tickets for 25 cents. The company was directed to make improvements in its rolling-stock and trackage, to discontinue certain cross-town lines and to provide more adequate service during the morning and evening rush hours. The higher fare went into effect on March 8.

The company's application for an increase had been before the commission since last December, when it asked permission to charge a 7-cent fare pending an investigation of its financial condition by a board of three members, representing respectively the city of Nashville, the commission and the company. It was proposed that a permanent rate should be based upon the findings of this board.

This is the second fare increase authorized by the commission within a few weeks, the Chattanooga Railway & Light Company having been authorized recently to charge 7-cent fares. The case of the Memphis Street Railway is now pending. Fares in Memphis were raised to 6 cents several months ago.

Louisville Program Under Way

Since the Louisville (Ky.) Railway was reorganized, the company is getting better official and public support, and the managerial committee, which is operating the road, reports progress. It is believed that the new president will be elected during the next three weeks. In the meantime the program will be started for working out the plans of future operation under the reorganization. Some improvement in service is being shown, and some slight economies have been effected in cost of operation. It is planned to drop several parallel lines, and increase carrying equipment on the ones remaining. This will result in faster and better service.

The management is posting notices on cars and in carhouses expressing its desire to improve service and asking maximum co-operation from employees and the public.

One of the notices says:

> To the public. We are endeavoring to provide the people of the city of Louisville with the best car service possible. We have the loyal support of the officials and the men of all departments, and we ask the hearty co-operation of the riding public.

Mayor Smith, the presidents of both boards of the General Council and the directors' managerial committee of the Louisville Railway conferred on March 4 with F. H. Sager, consulting engineer and traction expert of Chicago.

Jitneys Curbed in Muskogee

The city government at Muskogee, Okla., has taken action to stop the operation of jitneys that have been threatening the very life of the Muskogee Traction Company. When the company announced it would suspend all cars on its East Side lines if the jitneys were not stopped, Mayor F. B. Fite ordered the arrest of all owners and drivers of jitney buses. The city had been helpless to protect itself up to a week previous, when District Judge Watts in a decision held that the city had absolute control of its streets and that it was within its police powers to regulate and control, even to prohibition, the jitneys. Mayor Fite said:

> The railway company's revenue is being taken from it by the jitneys that operate just ahead of the cars on streets where cars run. We must protect the company's investment or be classed as a jitney town. I have instructed the police and legal departments of the city to use all their efforts in banishing the jitneys from our streets.

Details of I. R. T. Service Order

Public Service Commissioner Lewis Nixon of the First District, has issued an order directing the Interborough Rapid Transit Company to make material increases in the service which it renders on all of its subway lines, particularly in the non-rush hours. The order calls generally for ten-car expresses instead of eight-car, and six-car trains practically throughout the daytime non-rush hours. A part of the service increase also covers service in evening non-rush hours. Some increases are made in rush-hour local service.

The tracks are now operated practically to capacity for express service during rush hours, and no material increase is possible during such period. The service improvements directed by Commissioner Nixon will add to the service being operated in the non-rush hours a total of 600 cars more than are now operated in these hours, and about 30,000 more seats than are now furnished in these hours.

The order follows extensive investigations made by the commission into Interborough service. The commission gave the company until March 10 to determine whether it would accept the order, and to March 17 to put the new service into effect. The order was referred to briefly in the ELECTRIC RAILWAY JOURNAL for March 6, page 488.

Transportation News Notes

Would Retain 8-Cent Fare. — Rolla Wells, receiver for the United Railways, St. Louis, Mo., on March 4 applied to the State Public Service Commission for permission to continue in effect the 8-cent cash fare charged by the company.

Asks Hearing on Tube Raise.—The New Jersey Board of Public Utility Commissioners on March 6 sent a communication to the Interstate Commerce Commission asking for a public hearing on the reasonableness of a proposed fare increase on the lines of the Hudson & Manhattan Railroad. The company, which operates the tubes under the Hudson River connecting New York and New Jersey, has announced that on April 4 it will raise its fare to 8 cents. The present fare between the Hudson Terminal and Jersey City and Hoboken is 5 cents and between other stations in Manhattan and the latter points, 7 cents.

Freight Service Proposed for Cincinnati.—The Cincinnati (Ohio) Traction Company is working out plans for the establishment of a general freight service on its lines. Walter P. Draper, vice-president of the company, has suggested to Street Railway Director Culkins that the returns from such service would assist in relieving the system's financial condition. As a first step toward the organization of freight service negotiations have been started with several manufacturers of Norwood relative to their financing of an extension of the Edwards Road line to a connection with the South Norwood line.

Supreme Court to Pass on Fares.—The city of San Antonio, Tex., has taken steps to appeal to the United States Supreme Court in its contest with the San Antonio Public Service Company over the question of fares in San Antonio. The last court action was the granting last fall of an injunction in the Federal District Court by Judge Duval West restraining the city from interfering with the company in charging a fare sufficient to meet expenses and insure an adequate return on its investment. The company showed that the 5-cent fare fixed by the city was confiscatory, and on this showing Judge West based his decision. It is now charging a straight 7-cent fare.

Eight Cents Asked in Johnstown. — Notices of a proposed increase in fares to take effect April 1 have been posted by the Southern Cambria Railway, Johnstown, Pa. Single cash fares will be 8 cents for each zone, but tickets will be sold in books at the rate of 7½ cents a zone. There are ten zones on the line from Johnstown to Ebensburg, so that the increase will mean a maximum of 10 cents on a cash fare. On books of tickets, however, and on workmen's tickets, the actual increase is only 5 cents each way. New express tariffs have also been filed, but they provide for increases only on shipments weighing more than 500 pounds on which a reduction in rates had formerly been allowed.

Information at the Source.—As an aid to the improvement of railway service in Toledo, Ohio, officials of the Toledo Railways & Light Company who are not directly connected with the railway department of the company will be assigned to ride cars at rush hours and mix with the public for the purpose of obtaining suggestions from the car rider's viewpoint. On Feb. 25 the first assignments were made. Advertising Manager E. R. Kelsey discovered that

in a certain type of car additional straps in the front end would provide room for nearly twenty passengers. The improvement was immediately sanctioned by the railway department. Regular assignments to ride the cars will be made in the future.

Long Hauls Blamed for High Fare.—Street Railway Director W. C. Culkins of Cincinnati has submitted to the City Council a report outlining the reasons for the 7-cent fare charged by the Cincinnati Traction Company. The council had asked for an explanation of the conditions which made the 7-cent fare necessary. Mr. Culkins declares in his report that the city can hope for no reduction in fares until sparsely settled districts through which the company is now operating for long distances at a loss, are built up and become more densely populated. He points out that the company pays an annual city tax of $350,000. According to Mr. Culkins the use of the skip-stop resulted in a saving to the company of $60,000.

Secession Move in Staten Island.—A group of business men of Richmond Borough, Staten Island, N. Y., has organized a movement for the separation of the borough from New York City. The agitation for secession resulted from the transportation situation in Staten Island, a large part of which has been without electric railway service since the Staten Island Midland Railway suspended operation last January because of lack of funds, its request for a higher fare having been refused by the New York City Board of Estimate. A petition for the return of the trolleys at an increased fare has been signed by 15,000 Staten Islanders. The Richmond County Grand Jury is conducting an investigation of the trolley situation in the borough.

Wants Rochester Service Improved.—Corporation Counsel C. L. Pierce of Rochester, N. Y., has filed with the Public Service Commission for the Second District a brief in which he asks the commission to order improvements in the service furnished by the Rochester lines of the New York State Railways. The commission recently conducted three hearings at Rochester into the condition of the company. In his brief Mr. Pierce contends that the company can improve its service while continuing to operate on a 5-cent fare basis. He asks the commission to direct the company to carry out a definite schedule on each line, based upon a specific headway for the line as a whole, this service to continue for a trial period of three months, during which time the company's books should be open to public inspection.

Seven Cents in Worcester. — The Worcester (Mass.) Consolidated Street Railway on March 7 raised fares on its Worcester City lines from 6 cents in each zone to 7 cents and on its suburban zones from 5 cents to 6 cents. The increase was granted by the Massachusetts Department of Public Utilities on the application of Clark V. Wood, president of the company, who stated that an increase in revenue was necessary to prevent bankruptcy. The 7-cent fare is a temporary arrangement. The utilities commission will hold a hearing on April 1 as a preliminary to the fixing of a permanent rate. The company last December established two 5-cent zones on its Worcester lines. In January the fare in each zone was raised to 6 cents. The company's receipts were greatly reduced by interruptions in service during the recent blizzard.

Stricter Jitney Control Urged.—Retention of jitney competition with the Springfield (Mass.) lines of the Eastern Massachusetts Street Railway, is recommended in the report of the jitney committee of the Springfield City Council. The committee states that unrestricted jitney competition is in its opinion unfair, but urges that the vehicles be allowed to operate providing their regulation is made more strict. It recommends that each jitney be capable of carrying twenty persons and that each pay a $100 license fee, furnish a $1,000 cash bond and give $500 in bond or insurance for every passenger carried, thus making the total security at least $11,000 per vehicle. Jitney fares would be made the same as those charged by the Eastern Massachusetts Street Railway, and jitney routes would be lengthened and would include routes not served by the trolley company. The vehicles would operate eighteen hours a day and seven days a week.

Publicity Campaign to Curb Jitneys.—J. M. Ives, receiver for the Danbury & Bethel Street Railway, Danbury, Conn., is conducting a campaign of publicity through the advertising columns of Danbury newspapers, to interest the car riders of that city and Bethel in the company's plight. The company's receipts have been cut into by jitney competition, especially on the Bethel line. Mr. Ives used a full page in the Danbury *Evening News* on Feb. 24 to explain the seriousness of the company's situation, pointing out that, if unrestricted jitney competition continues, the company will be compelled to abandon service on the Bethel line. To bring home to the public what such a suspension would mean, he reprinted in part the article in the January issue of *Aera* dealing with the Toledo situation. On Feb. 28 he reprinted in the *Evening News* extracts from the article in the ELECTRIC RAILWAY JOURNAL for Jan. 31 on the trolley-jitney fight in Massachusetts.

Asks Seven Cents in Fort Wayne.—Robert M. Feustel, president of the Fort Wayne & Northern Indiana Traction Company, operating the lines in Fort Wayne and interurban lines to Bluffton, Huntington and Lafayette, Ind., has petitioned the Indiana Public Service Commission for authority to increase the fare on the Fort Wayne city lines. He asks for permission to charge a 7-cent cash fare and a 6-cent ticket rate. In applying for a higher fare Mr. Feustel stated that the company planned to grant its employees a substantial advance in wages. The company in a public statement recently gave prominence to the following facts concerning its financial condition: Total revenues for the year 1919, $730,809; total operating expenses $638,225; taxes $11,257; net available for returns on investment, $81,327; return on investment of $2,780,000, 2.88 per cent; revenue passengers carried 14,026,200; transfer passengers carried, 2,805,202; average passengers per day, 46,113.

Wins Appeal Against Car-Shortage Penalty.—The Judicial Committee of the Imperial Privy Council has allowed the appeal of the Toronto (Ont.) Railway against a penalty of $1,000 a day for twenty-four days imposed by the Ontario Railway & Municipal Board for failure to carry out the board's order of Nov. 9, 1914, for the supply of 100 double-truck cars by Jan. 1, 1918. Owing to war conditions the company was unable at that time to supply the cars. The city, however, made several applications to the board to compel the company to comply with the provisions of the order. The matter drifted until early in 1918, when special legislation was passed by the Ontario Legislature providing a penalty not exceeding $1,000 a day for non-compliance with an order of the board. The law became effective on March 26, 1918; the board thereupon inflicted a penalty of $1,000 a day from that date for failure to provide 100 cars by Jan. 1, 1918. The company immediately appealed on the ground that the board had no authority to make such an order and that the company had made every effort to supply the cars but was unable to do so because of war conditions.

Would Bar Jitneys From Thoroughfare.—John A. Beeler, who is conducting a survey of traffic conditions in Kansas City, Mo., has submitted a report to the board of control of the Kansas City Railways in which he recommends regulation of vehicular traffic and the installation of loading platforms for the relief of congestion in Main Street. Mr. Beeler would forbid the operation of jitneys on Main Street within the congested district. He maintains that the operation of jitneys in Main Street constitutes a serious hindrance to the operation of street cars, pointing out that they constitute 35 per cent of the vehicular traffic in that thoroughfare. During the period from 4 p.m. to 6 p.m. on a certain day recently a count at Twelfth and Main Streets showed that 795 passenger automobiles carried 1,547 persons including drivers, or an average of 1.9 persons per car. Jitneys numbering 324 carried 1,349 persons, or an average of 4.2 persons per vehicle, not including the driver. Regulations proposed by Mr. Beeler have already been put in effect on Tenth Street. These provide for the relocation of stops, the employment of double-berthing, the readjustment of positive stops, giving the right of way to the heavy lines and precedence to street cars over other traffic.

Personal Mention

Mr. Mitchell Steps Up

General Manager of West Penn Railways Succeeds Williston Fish as Vice-President of System

H. L. Mitchell, general manager of the West Penn Railways, Pittsburgh, Pa., on March 1 assumed the duties of vice-president of the system. Mr. Mitchell was elected to the vice-presidency at a recent meeting of the board of directors to fill the vacancy caused by the resignation of Williston Fish. The latter has been appointed general manager of the Chicago (Ill.) Surface lines, as announced in previous issues of the ELECTRIC RAILWAY JOURNAL.

EIGHTEEN YEARS WITH SYSTEM

Mr. Mitchell has been identified with the West Penn Railways and the companies which it controls during the period of their development into one of the most important utility systems in Pennsylvania. The lines of the company radiate through the Connellsville coke region of southwestern Pennsylvania, penetrating the Wheeling district of West Virginia. Mr. Mitchell has had an active part in building up and organizing this net-work of lines. His election to the vice-presidency came just eighteen years from the date of his first connection with the system.

He entered the employ of the old Pittsburgh, McKeesport & Connellsville Railway at Pittsburgh on March 1, 1902. On February 13, 1903, when the general offices of that road were moved to Connellsville, he became chief clerk to Thomas Elliot, then general manager. From that date until July 1, 1911, he held various positions with the company, among them those of paymaster and office manager. He also had charge of the general and district stores department.

MR. MITCHELL ALSO AT WHEELING

On July 1, 1911, when the West Penn interests acquired additional lighting and railway property in Allegheny, Butler, Armstrong, Washington and Green Counties, Mr. Mitchell was transferred to Pittsburgh as assistant to W. E. Moore, vice-president and general manager. At the time of the reorganization of the West Penn System in November, 1918, he was made assistant manager of the light and power department, continuing in that capacity until July 1, 1918, when he entered the office of Williston Fish as assistant to the vice-president. On Sept. 15, 1918, he was transferred to Wheeling as vice-president and general manager of the Wheeling Traction Company and on Feb. 1, 1919, returned to Pittsburgh as general manager of the West Penn Railways.

Augustus T. Throop, superintendent of the light and power departments of the Wilmington & Philadelphia Traction Company, Wilmington, Del., has resigned.

E. B. Atchley Joins Akron Company

E. B. Atchley, publicity manager of the Kansas City (Mo.) Railways, has resigned, effective March 15, to direct the publicity work of the Northern Ohio Traction & Light Company, Akron, Ohio. Mr. Atchley leaves Kansas City



E. B. ATCHLEY

after four years of service under President Philip J. Kealy. During this time he established a monthly magazine for the employees of the company and a weekly leaflet dealing with public affairs which is distributed on the company's cars. Both publications are known as the *Railwayan*, and both have been very successful in promoting a community of interest between company and employees on the one hand and company and patrons on the other.

Mr. Atchley has had a free hand in promoting the interests of the Kansas City Railways through broad and open publicity policies, and has wielded a material influence in making the company's motive understood by the people during the troublous times of the past few years. Prior to his connection with the company he was editor of the Kansas City *Post*, and previous to that was associated in an editorial capacity with the Kansas City *Star*, the St. Louis *Globe-Democrat*, the Omaha *Bee*, and other newspapers.

In going to Akron, Mr. Atchley will take with him the creed which he formulated into ten commandments expressing the policies and aims of the street railway, when he undertook his connection with the Kansas City Railways. This creed has stood the test of four years' application, and it will now be applied to the territory served by the Northern Ohio Traction & Light Company. Mr. Atchley's "Ten Commandments" follow:

1. Thou shalt not, in any manner, deceive the public, and those working, being of themselves the company, shall be likewise undeceived.
2. Thou shalt furnish a proper service for a just compensation at all times.
3. Thou shalt deal fairly with those who ride in the cars, and recognize the rights of the men who operate them.
4. Remember thy promises always and keep them.
5. Seven days, day and night, rain or shine, shalt thou labor. There is no rest for thee. For the people must have transportation continually.
6. Thou shalt not have "watered" stock or engage in stock juggling. The time for that is past.
7. Honor the city and the community in which you have car lines, that the relationship may be pleasant and that the city and community may continue to be blest by growth.
8. Thou shalt not operate cars recklessly.
9. Thou shalt keep thy cars clean and sanitary and in good repair.
10. Thou shalt not squander the money entrusted to thy care by the people who ride in the cars for those who have built the street railway system. Remember, thou art but husbanding such money, acting as agent for the owners and the people, to produce the maximum service for the minimum cost.

Mr. Hill Returns to California

W. V. Hill, who resigned recently as manager of the Washington office of the American Electric Railway Association, has returned to California, where he will resume his duties as manager of the California Electric Railway Association. Mr. Hill's work at Washington for the national body commenced when he was appointed assistant manager of the American Electric Railway War Board under E. C. Faber. Both in this post and in the other capacities in which he served the association so successfully at Washington, Mr. Hill was able to draw on the large fund of information which he had accumulated in his long and varied experience in active railway work and as manager of the California association.

As stated in the ELECTRIC RAILWAY JOURNAL for March 6, an arrangement has been made with Charles L. Henry, president of the Indianapolis & Cincinnati Traction Company, Indianapolis, Ind., and chairman of the committee on national relations, to take over the active supervision of the affairs of the Washington office.

Mr. Henry will give as much of his time to this work as may be necessary. The office will be open continuously and all communications addressed to Mr. Henry at 950 Munsey Building, Washington, D. C., will receive prompt attention.

The Washington office of the association is equipped to act as agent before the Interstate Commerce Commission for member companies of the association requiring this service. Such companies as are not so represented or who desire to make a change in their present arrangement should communicate with Mr. Henry at Washington.

Executives and others connected with member companies having business in Washington are urged to make the association's rooms their headquarters.

Mr. Heindle Leaves Railway Work

William A. Heindle, general superintendent of the Wilmington & Philadelphia Traction Company, Wilmington, Del., has tendered his resignation to take effect on April 1. On that date Mr. Heindle will go into business in Wilmington as an engineer and contractor. He has been connected with the company since 1910.

Mr. Heindle was graduated from Lehigh University in 1891 with the degree of civil engineer. For the next three years he was employed by the Baltimore City Passenger Railway in the construction of cable and overhead trolley lines. From 1894 to 1899 he was engaged in the construction of lines in Washington, D. C. In 1900 he became associated with J. G. White & Company, Ltd., London, Eng., on engineering contracts in Great Britain and on the Continent.

Returning to the United States in 1906 Mr. Heindle served for four years as supervising and electric railway engineer with J. G. White & Company, Inc., New York. He resigned in 1910 to join the Wilmington & Philadelphia Traction Company.

Mr. Hoover Gets First Washington Award

Herbert C. Hoover was presented with the Washington Award, founded in 1916 by John W. Alvord, at a dinner in his honor in Chicago on Feb. 28. The Western Society of Engineers acted as spokesman for the founder societies and Charles F. Loweth, chairman of the Washington Award Commission, made the presentation speech. Onward Bates spoke as a representative of the American Society of Civil Engineers, James Rowland Bibbins for the American Society of Mechanical Engineers, Bion J. Arnold for the American Institute of Electrical Engineers and Charles H. MacDowell for the American Institute of Mining and Metallurgical Engineers.

To use the words of the donor, the award is for presentation annually "to a member of the engineering profession who has accomplished much for the world about him in vital, important, far-reaching ways, and whose services in general have been noteworthy for merit in promoting the public welfare."

In his acceptance address Mr. Hoover stated that he could not accept the award except as a way of doing homage in a measure to the 1,000 engineers who had associated themselves with him in his work. His address dealt in general with the inter-relationship of general industries and food production and distribution.

Charles N. Ryan, secretary and treasurer of the Wilmington & Philadelphia Traction Company, Wilmington, Del., has resigned.

Edgar E. Clark, of Iowa, has been elected chairman of the Interstate Commerce Commission. The office of chairman is occupied in rotation.

Kenneth P. Allen has been appointed assistant equipment engineer of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis. Mr. Allen was formerly connected with the engineering department of the Firestone Tire & Rubber Company.

Charles R. Wright, who for some time past has been connected with the Knoxville Railway & Light Company, Knoxville, Tenn., has resigned to accept a position with the Acme Electric Company, which does electrical contracting.

P. T. Reilly, superintendent of transportation of the Scranton (Pa.) Railway will sever his connection with the company on April 1 to accept the position of general superintendent of the Wilmington & Philadelphia Traction Company, Wilmington, Del.

William E. Dowdell has been appointed general superintendent of the Portsmouth Electric Branch of the Boston & Maine Railroad, with headquarters at Portsmouth, N. H. Mr. Dowdell was formerly assistant general superintendent of the line, which operates between Portsmouth, Rye and North Hampton.

Rodney Hitt, who was associate editor of ELECTRIC RAILWAY JOURNAL from 1908 to 1912, has organized the firm of Hitt, Farwell & Park, with headquarters at 37 Liberty Street, New York, to transact a general investment business. For the past eight years Mr. Hitt has been associated with White, Weld & Company, bankers, New York.

R. A. Leussler, general manager of the Omaha & Council Bluffs Street Railway, Omaha, Neb., was elected second vice-president of the company at the annual meeting of the board of directors. Mr. Leussler will continue to perform the duties of general manager. He has been connected with the company since 1906. A biography and portrait of Mr. Leussler were published in the ELECTRIC RAILWAY JOURNAL at the time of his appointment as general manager in October, 1919.

Archibald Page, general manager of the Clyde Valley Electrical Power Company, Scotland, has resigned. Mr. Page has been appointed a technical member of the Commission under the Ministry of Transport for the control of the electrical supply of the kingdom. In last week's issue it was erroneously stated that Mr. Page had resigned as general manager of the Glasgow Corporation Tramways Department. Mr. Page has at no time been connected with the latter organization.

William B. Skelton, whose election as president of the Androscoggin & Kennebec Railway, Lewiston, Me., was noted in the ELECTRIC RAILWAY JOURNAL for Feb. 21, was born in Bowdoin, Me., in 1871. He was graduated from Bates College in 1892, and in the following year was admitted to the bar. In addition to the practice of law in Lewiston he has taken an active part in municipal and State affairs, serving as Mayor of Lewiston from 1903 to 1905 and as Judge Advocate General with the rank of Colonel on the staff of Governor Cobb from 1905 to 1909. From 1914 to 1919 he served on the State Public Utilities Commission. Mr. Skelton is a member of the law firm of White, Carter & Skelton, Lewiston.

W. V. Neal, assistant general manager of the Monongahela Valley Traction Company, Fairmont, W. Va., has tendered his resignation, to take effect on March 15. Mr. Neal plans to enter the provision business in Clarksburg, W. Va. Before joining the Monongahela Valley Traction Company in January, 1919, he was connected with the Trinidad Electric Transmission, Railway & Gas Comany, Trinidad, Col. For several years he was connected with the Stone & Webster interests with headquarters at El Paso, Tex. He was at one time an employee of the United States Government and had charge of the construction of a number of engineering projects in the Philippine Islands.

Harry C. Stevenson, formerly auditor of the Elizabeth, Plainfield & Central New Jersey Railway and later assistant to Edmund W. Wakelee, vice-president of the Public Service Corporation, has been promoted to personal representative to Thomas N. McCarter, president of the latter company. Mr. Stevenson began his business career in May, 1897, as secretary to Thomas N. Barr, then president of the Worcester (Mass.) Consolidated Street Railway. In 1901 Mr. Barr became the president of the Elizabeth, Plainfield & Central New Jersey Railway at the same time Mr. Stevenson was made auditor. Mr. Stevenson entered the Public Service Corporation when that organization was formed in 1903. In 1907 he was made assistant secretary to the Public Service and its underlying companies, becoming assistant with Mr. Wakelee in April, 1917. Mr. Stevenson will be assigned to the southern division which embraces Camden and the territory as far north as Trenton.

Obituary

R. L. Cadwell, construction engineer of Georgia Railway & Power Company, Atlanta, Ga., died recently at his home in Tallulah Falls, Ga.

A. H. Rogers, president of the Southwest Missouri Railroad, Webb City, Mo., died on March 6 in Los Angeles, Cal. Mr. Rogers was president of the Globe Publishing Company, Joplin, Mo.

H. M. Davis, manager of the advertising department of the Sprague Electric Works of the General Electric Company, died at his home in Brooklyn on Feb. 9. He had been connected with the Sprague Company since December, 1899.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Heavy Ordering of Electrical Sheets

Full Capacity Booked by Mills for First and Second Quarters—Higher Prices Expected For Third Quarter

Steel mills are entirely booked up on electrical sheet through the first half of the year. Where books were opened in November for the first half, the mills concerned had no difficulty in taking care of their capacity in a very short time. Where booking by the quarter is practiced, second-quarter capacity was contracted for in almost no time a few weeks ago, and in some districts a good part of it was done over the telephone.

Realizing that the demand was far ahead of the supply, the mills and their agents writing up second-quarter business first took care of their regular trade of long standing; and even these customers were not always able to secure sufficient sheets to supply their needs. District agents had only their allotment of mill capacity, and this in turn had to be allotted further. New customers and new manufacturers in the field were hard put to it to obtain material, but apparently jobbers held sufficient of the electrical sheets to supply part of their needs anyway.

During the first quarter some customers bought heavily, really more than they would consume in that period, but they were a little ahead of the game when second quarter was allotted. Consequently some mills had small amounts extra that they could hand out, and these were eagerly snapped up by other than regular customers. In one case in point, where the mill agent offered one of these small lots to a rather new customer, the latter was in no hurry to take it. Two weeks later, when he wrote in for it he was much upset to learn that it had been gobbled up by another firm. That is merely one instance in which the nature of the market is shown. Electrical sheets are not now being sold over the counter at the buyer's will.

Books for the second half year or for the third quarter are not yet open. Mills expect just as large a demand as that experienced over the first half year. Slightly better capacity will be available, it is reported. A loosening up of the labor market would place the industry on a still better basis. It is expected that orders may be placed along toward the end of April or early in May when the books will be open. Prices for the second half year will probably be higher than those quoted for the first half, while those for the third quarter are hardly expected to show much advance over those of the second quarter.

The foreign demand for sheets is heavy, but there is extremely little capacity set aside to serve it. In some cases there has been no allotment whatever set aside for this market. Actual orders are on hand for a considerable tonnage from European countries, but the mills have been unable to fill them and care for their regular domestic trade too. In some quarters this policy has been questioned because the good will which might be built up at this time might be very acceptable when the demand for sheets shall have decreased in the domestic market and a foreign outlet for an excess mill capacity be sought.

It has been contended in some quarters that small tonnages would materially help the foreign situation now and undoubtedly help the domestic mill in the future.

Rolling Stock Purchases Break Records

More Than 1/3 as Many Cars as Were Bought During the Whole of 1919 for City Service Have Been Ordered in January and February, 1920

Safety car purchases during January and February have broken all records. For the first two months alone, as far as is known, 545 of these quicker-headway, minimum-energy-demanding safeties have been ordered from the different carbuilders, although late returns may swell the total to more than 600. The former number is equivalent to more than 25 per cent of all cars ordered during the past year for city service.

TABLE 1—SAFETY CARS ORDERED DURING JAN. & FEB., 1920

New England States	
Biddeford & Saco R.R.	2
Boston Elevated Ry.	31
Concord (N. H.) St. Ry.	4
	37
Middle Atlantic States	
Empire State Ry. Corp.	6
Reading Transit & Lt. Co.	12
Salem & Pennsgrove	6
Trenton, Bristol & Philadelphia Ry.	6
Trenton & Mercer Co. Traction	40
United Rys. & Electric Co.	33
Westchester St. Ry.	6
	109
Southern States	
Baton Rouge Electric Ry.	8
Birmingham Ry. Lt. & Pr. Co.	10
Columbus (Ga.) R.R.	9
Mobile Lt. & R.R.	10
Monongahela Valley Traction	8
Tampa (Fla.) Electric Ry.	8
	53
East Central States	
Hodenpyl Hardy & Co.	118
Galesburg Ry., Lt. & Pr.	20
Indiana Ry. & Lt. Co.	10
Decatur Ry & Lt Co.	6
Pekin (Ill.) Municipal Ry.	3
Peoria Ry.	20
Urbana & Champaign Ry	6
	183
West Central States	
El Paso Electric Ry.	10
Galveston Electric Ry	15
Grand Forks (N. D.) St. Ry	6
Lincoln Traction Co.	15
Northern Texas Traction	25
Peoples Gas & Elec., Burlington, Ia.	6
Topeka Ry.	8
	85
Rocky Mountain and Pacific Coast States	
Everett Ry., Lt. & Pr.	2
Los Angeles Ry.	45
San Francisco-Oakland Term.	25
Tacoma Ry & Pr.	6
	78
Total companies placing orders	43
Total safety cars ordered	545

Table I gives the list of railways ordering safety cars and is but a slight indication of what may be expected later. Five large city railways are reported to hold options for a total of more than 400 safeties and the greater number of these are expected to be placed during the next sixty days.

With the railways all over the United States in both large and small cities ordering safeties at a rate of between 3,000 and 4,000 cars a year, manufacturers are actively planning production on a large scale to meet the demand which is everywhere apparent. The rush for sheets, plates and shapes, control, air brake equipment, door and step control equipment, motors, etc., has been so strong that manufacturers of the different products are swamped and already long deliveries are being quoted, which may make it physically impossible for the carbuilders to turn out the increasingly large number of

With the 181 double-truck motor cars and trailers added, which have been placed during January and February, as shown in Table II, rolling stock purchases amounting to 726 cars for the two months are equivalent to more than 33⅓ per cent of the total number of cars ordered during 1919 for city service. This number is 126 cars greater than the conservative estimate of the ELECTRIC RAILWAY JOURNAL made early in the year for cars to be purchased during the first two months. Also reference to this table shows the decided trend toward the use of safety cars. The total of double-truck motor cars and trailers, however, does not include electrified steam roads, hence the seventy cars ordered by the Long Island Railroad for its electric division are not included.

safety cars that will be required by the railways.

The St. Louis Car Company, since the completion of its many war contracts, has made necessary changes in the arrangement of its plant to turn out safety cars on a large scale. For the present shop facilities have been arranged for the production of five safety cars per working day. Deliveries by this company, which are thought to be very good, will be announced at a later date. The company also contemplates selling its safety cars, which are of the standard type, direct to the railways.

TABLE II—COMPARISON OF NEW ROLLING STOCK FOR CITY SERVICE

	1916	1917	1918	1919	Jan.-Feb. 1920
Safety cars	187	280	644	1,383	545
Double truck motors, cars and trailers...	2,859	1,718	1,198	746	181

The Osgood-Bradley Car Company is preparing its shops for quantity production. It is reported that the company is now building 300 safety cars for stock purposes although it is known that perhaps 100 of these have already been spoken for.

Prospects for a heavy volume of business in all kinds of equipment accessories and supplies used in the manufacture of both safety cars and double truck cars never were brighter and manufacturers and railway supply men are now openly enthusiastic about the prospects for the coming months.

New Officers of Galena Signal Oil

At the annual meeting on Feb. 24 of the Galena-Signal Oil Company, Franklin, Pa., a stockholders' advisory committee was created consisting of J. S. Cullinan, John B. Dennis and Frederick Strauss, and several changes made in officers and directors. Lauren J. Drake was elected president to succeed J. S. Cullinan who becomes a member of the new committee. W. A. Trubee, who was district manager at New York, and W. F. Walsh, who was district manager at Chicago, become vice-presidents. L. F. Jordan remains as vice-president at New York and F. E. Linahen as vice-president at Franklin. F. French Miller was elected secretary-treasurer at Franklin, L. W. Stull as assistant secretary and assistant treasurer at Franklin and C. W. Hochette as assistant secretary and assistant treasurer at New York.

The directors re-elected are: L. J. Drake, L. F. Jordan, J. French Miller and E. V. Sedgwick. In addition, F. E. Linahen, W. A. Trubee and H. S. Skinner were added to the board.

Lauren J. Drake, the new president of the company, was born at Keokuk, Iowa, on Aug. 27, 1880. He was educated in the public schools of Omaha, Neb., and Chicago, Ill., and in 1899 was graduated from the Shattuck Military School, Faribault, Minn. He then entered the oil business and in 1905 he joined the Galena-Signal Oil Company and was a representative of that company in the Middle West. In 1916 he was transferred to the company's executive offices in New York to become vice-president and director of the company. As president, Mr. Drake will have his headquarters in New York.

W. A. Trubee, who has been elected a vice-president and director with headquarters at New York, was born in Bridgeport, Conn., on March 22, 1867. He attended a private school in Bridgeport and later the Greylock Institute at South Williamson, Mass. During February, 1898, he entered the service of Galena-Signal Oil Company as sales representative at Bridgeport, Conn. In May, 1912, he was transferred to New York office and in March, 1919, he was appointed district manager at New York, which position he held until his recent election as vice-president and director of the company.

National Federation Construction Industries to Meet

The first annual meeting of the National Federation of Construction Industries will be held at the Hotel Sherman, Chicago, March 24-25. The chief business of the meeting will be consideration of several important proposed changes in the by-laws of the organization. Through changes in the by-laws, it is proposed to increase the number of vice-presidents, create an advisory board, provide for a staff council and take measures to develop district organization.

Rolling Stock

Boston Elevated Buys Seventy Large Cars

The Boston Elevated Railway, which was mentioned in the Feb. 7 issue of the ELECTRIC RAILWAY JOURNAL as being in the market for 100 cars, has now placed orders for this number of cars with three different car builders. As previously announced, thirty safety cars were placed with the J. G. Brill Company.

Forty cars for use on the elevated line, similar to those now in use, have just been ordered from the Pressed Steel Car Company. In addition an order has been placed with the Laconia Car Company for thirty standard center-entrance double-truck surface cars equipped for train operation.

Westchester Street Railway, White Plains, N. Y., noted in the Jan. 3rd issue of the ELECTRIC RAILWAY JOURNAL as being in the market for safety cars, has placed an order with the Osgood-Bradley Car Company for six safety cars.

New York & Stamford Railway, Port Chester, N. Y., noted in the Jan. 3rd issue of the ELECTRIC RAILWAY JOURNAL as being in the market for safety cars, has placed an order with the Osgood-Bradley Car Company for seven safety cars.

Boston (Mass.) Elevated Railway, noted in Feb. 7th issue as having placed an order for thirty Birney safety cars, has specified the following details.

Number of cars	30
Builder	J. G. Brill Company
Type	Safety
Seating capacity	32
Length over all	28 ft. ¼ in.
Truck wheelbase	8 ft. 0 in.
Width over all	7 ft. 10⅜ in.
Interior trim	Bronze
Headlining	None
Air brakes	G. E. (CP-27 compressor)
Axles	Hammered steel, 3 in. x 6 in. journal
Couplers	Pocket in bumper
Fixtures	Curtain supply
Curtain material	Pantasote
Designation signs	Hunter illuminated
Door operating mechanism	Brill
Fare boxes	International hand
Fenders or wheelguards	H. B.
Heaters	12 Cutler-Hammer panel
Headlights	Crouse-Hinds incandescent
Journal bearings	Friction
Motors	G. E. 264
Motors	Inside hung
Sanders	Ohio Brass, air
Seats	J. G. Brill
Seating material	Wood—J. G. Brill
Trolley catchers retrievers	Ohio Brass & Keystone
Trucks	Brill special 79-E-1
Ventilators	8-Brill exhaust
Wheels	26 in. diameter steel
Special devices	Railway Utility heat regulators

Reading Transit & Light Company, Reading, Pa., noted in the Feb. 28 issue of the ELECTRIC RAILWAY JOURNAL as having placed an order for twelve safety cars with the Osgood-Bradley Car Company, has specified the following details:

Number of cars ordered	12
Date of order	Feb. 5, 1920
Delivery	In six weeks
Builder	Osgood Bradley Car Company
Type	Semi-convertible safety
Seating capacity	32
Weight, total	16,000 lb.
Length over all	27 ft. 9⅞ in.
Truck wheelbase	8 ft. 0 in.
Width over all	7 ft. 9⅜ in.
Height	10 ft. 3⅞ in.
Body	Semi-steel
Interior trim	Birch
Roof	Arch
Air brakes	G. E.
Armature bearings	Roller
Axles	A. E. R. A. No. E-2
Signals	Consolidated car heating
Control	K-10
Designation signs	Hunter
Fare boxes	Johnson
Hand brakes	Brake shafts
Heaters	Gold double-coil
Headlights	Golden Glow SM-95
Journal bearings	Roller
Lightning arresters	Garton Daniels
Motors	Two No. 264 G. E.
Motors	Inside hung
Paint, varnish or enamel	Both
Registers	International
Sanders	Air operated
Seats	Osgood Bradley
Seating material	Slat type
Trolley catchers or retrievers	Earll No. 10
Trucks	Osgood Bradley type 25-96
Wheels	Griffin FCS

Recent Incorporations

Wichita Fall, Tex.—An electric railway from Wichita Falls to Burkburnett and thence to Wagoner City, is proposed. Representitives of eastern capitalists have been in Wichita Falls looking over the territory which would be served by the road. The line would be seventeen miles in length.

Houston, Richmond & San Antonio Traction Company, Houston, Tex.—The name of the Houston, Richmond & Western Traction Company, which plans to build an electric line from Houston to San Antonio, has been changed to the Houston, Richmond & San Antonio Traction Company. Work

on the road will begin shortly. H. A. Halverton of Houston is president of the company.

Spirit Lake Railway & Power Company, Vancouver, Wash.—Articles of incorporation were filed on Feb. 26 by the Spirit Lake Railway & Power company with a capitalization of $350,000. The company is incorporated to operate railways, steamboats on the Columbia River, power plant, generate power, deal in real estate, maintain telephone and telegraph lines, etc. The stock is $1 per share. The trustees are: Dr. Joseph Roane, C. C. Brown and James E. Rice, all of Vancouver.

Track and Roadway

Macon Railway & Light Company, Macon, Ga. — The Georgia Railroad Commission has refused to allow the Macon Railway & Light Company to discontinue service on its Rivoli extension. The company had asked permission to take up the tracks.

Paducah (Ky.) Railway.—The Paducah Railway and the Paducah Electric Company plan to make improvements in their facilities at a total cost of $250,000. The city's car lines will be largely reconstructed. The cost of improvements to the power and light plant will amount to $175,000.

Boston (Mass.) Elevated Railway.—The Boston Elevated Railway will make improvements to its line at Watertown Square.

Kansas City (Mo.) Railways.—The Kansas City Railways has begun work on a line in Eighteenth Street from Central Avenue to Kansas Avenue, Kansas City, Kan.

Cincinnati (Ohio) Traction Company.—The Cincinnati Traction Company has opened negotiations with a number of Norwood manufacturers looking to the extension of the Edwards Road line to connect with the South Norwood line.

Power Houses, Shops and Buildings

Sacramento Northern Railroad, Sacramento, Cal. — This company has opened a new passenger and freight station at Marysville, Cal.

Fitchburgh & Leominster Street Railway, Fitchburg, Mass.—The carhouse of the Fitchburg & Leominster Street Railway with two cars containing tools and other equipment, was destroyed by fire on March 5. The loss amounts to $75,000.

Manchester (N. H.) Street Railway.—A carhouse of the Manchester Street Railway was damaged by fire recently.

Northwestern Ohio Railway & Power Company, Toledo, Ohio. — This company has under construction a transmission line from Curtis, along the shore of Lake Erie to Ryan a distance of twelve miles.

Trade Notes

Rhode Island Glass Company, of the General Electric Company, has begun work on an addition to its plant at Central Falls, R. I. The new building will be about 50 ft. x 96 ft. and will be three stories high.

Van Dorn Electric Tool Company, Cleveland, Ohio, is building a four-story addition of 30,000 sq.ft. of floor space for the manufacture of portable electric drills, reamers and grinders.

A. S. Winter, formerly connected as advertising and sales manager for the William Powell Company, has joined the sales force of the Fairbanks Company, of Pittsburgh, Pa., and will represent them in southern Ohio.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces that J. G. Miles, head of the insulation section, has been transferred to the Seattle district office as manager of the supply department.

National Exposition of American Manufacturers, which was to have been held in April, 1920, at Buenos Aires, Argentine Republic, has been postponed until November, 1920, to allow more time for adequate preparations and shipments from other parts of North and South America.

Johnson Fare Box Company, Chicago, Ill., has received an order for 110 registering fare boxes and for metal tickets to be sold four for 25 cents from the Nashville Railway & Light Company. These are in addition to the fifty boxes which the company now has in use.

American Engineering Association will hold its 21st annual convention in Chicago on March 16 to 18. Except for the annual dinner on the 17th the time will be occupied entirely with consideration of the numerous committee reports. The usual exhibition of railway appliances and machinery will be at the Coliseum, March 15 to 18.

F. M. Nourse has joined the Charles L. Benjamin organization at Chicago. Mr. Nourse has been an engineer in the advertising department of the Cutler-Hammer Manufacturing Company, at Milwaukee, Wis., for the past two years and prior to that was associated with the Wisconsin Power, Light & Heat Company, at Portage, Wis.

Lapp Insulator Company, Le Roy, N. Y., announces that it is proceeding immediately to the erection of an additional factory and the installation of considerable new machinery to increase its capacity 60 per cent within the next five months. The capital is also being increased from $150,000 to $500,000 to take care of rapidly increasing business.

Century Electric Company, St. Louis, Mo., is proceeding to increase its manufacturing facilities about 60 per cent by the erection of a 180-ft. x 106-ft. six-story factory building near the present plant. The company has purchased sufficient ground to provide for the growth of its business for some years to come. The present addition is to permit expansion in the lines of alternating-current motors.

Westinghouse Air Brake Company, Pittsburgh, Pa., Catalog unit No. 2021 describing its standardized UC brake equipment for steam road passenger trains, and which, with simple electric attachments, is claimed to comprise the highest development of electro-pneumatic train brake for both electric and steam road passenger trains. The pamphlet is well prepared both as to text matter and illustrations.

Green Fuel Economizer Company, Beacon, N. Y., announces the opening of an office at 1006 Finance Building, Philadelphia. The office will be in charge of W. F. Wurster, assisted by G. E. Kille. The company was formerly represented in this territory by the Baker-Dunbar-Allen Company. Mr. Wurster has been doing engineering and sales department work with the Green Fuel Economizer Company for the last six years.

Martindale Electric Company, 11,737 Detroit Avenue, Cleveland, Ohio, is the new name of what was formerly The Handy Supply & Manufacturing Company, the change dating from Jan. 1. E. H. Martindale is president and general manager and only recently resigned as sales engineer of the National Carbon Company to become president of The Handy Supply & Manufacturing Company. Mr. Martindale is a graduate of Case School of Applied Science, class of 1908, a member of the board of directors of the American Institute of Electrical Engineers and spent a year in France as captain in an engineering regiment. In addition to its business in commutator stones, commutator slotting files and insulating varnishes, the Martindale Electric Company will act as exclusive agent for Volk refillable fuses, Marble-Card direct-current motors and generators, St. Louis Electrical Works alternating-current motors as well as distributing products of the Efficiency Electric Company.

New Advertising Literature

Breeze Manufacturing Company, Newark, N. J.: A folder giving the many uses of "Fle-x-met," a flexible metallic tubing.

Magnolia Metal Company, New York, N. Y.: A twenty-four-page booklet "New Truths and Old Fallacies" containing instructive information concerning babbitt metals.

Laclede-Christy, St. Louis, Mo.: A forty-two-page bulletin, "Boiler Capacities with Chain Grates," showing the importance of fuel-bed temperatures in increasing the maximum capacity attainable.

Wellman-Seaver-Morgan Company, Cleveland, Ohio.: Bulletin 49. 8½ x 11 in.; illustrated. Description of this company's open-top railroad car dumper, showing some installations with working drawings of device.

Fort Wayne Safety Cars

equipped with

Peacock Staffless Brakes



In order to handle crowds without delay it is important to have the maximum amount of platform space on safety cars.

Peacock Staffless Brakes occupy one-half the space, weigh no more and give three times the power of the ordinary hand brake.



"The Peacock Staffless."

These are the reasons why the Fort Wayne and Northern Indiana Traction Company specified the Peacock Staffless Brake for their latest Safety Cars (40 in number) which are now in operation.

To insure safe braking at all times and on all cars call for Peacock Brakes in your new specifications.

"The Brake Book" is yours on request.

National Brake Company

Buffalo, N. Y.

Bankers and Engineers

Ford, Bacon & Davis,
Engineers.
115 BROADWAY
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Engineers — Contractors
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Industrial Plants and Buildings. Steam Power Stations. Water Power Developments. Substations. Gas Plants. Transmission Lines. Electric and Steam Railroad Work.
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First National Bank Bldg.
CHICAGO
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THE ARNOLD COMPANY
ENGINEERS—CONSTRUCTORS
ELECTRICAL—CIVIL—MECHANICAL
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Engineer
Reports, Appraisals, Reorganizations
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ALBERT S. RICHEY
ELECTRIC RAILWAY ENGINEER
WORCESTER POLYTECHNIC INSTITUTE
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The Most Successful Men in the Electric Railway Industry read the
ELECTRIC RAILWAY JOURNAL
Every Week

Carnegie Steel Wheels

give the most satisfactory service over the longest period of time, meaning ultimate economy in expenditure.

They are backed up by a record of achievement. No matter where they may be in use, steam railroad, electric railway or industrial service, they make good. A wheel sold to the Bessemer & Lake Erie R. R. had a record of 155,803 miles, turned once. A 33-in. street car wheel used by the Boston Elevated Railway Company attained 151,355 miles, not turned. A 33-in. freight car wheel sold to the Berwind-White Coal Mining Company ran 171,280 miles, not turned. Records like these, and many, many others, make Carnegie Steel Wheels a real investment.

Our engineers would be glad to confer with you on any problem, be it track or rolling stock. This company is well equipped to take care of your needs. We invite your inquiries.

Carnegie Steel Company

General Offices: Carnegie Building, Pittsburgh, Pa.

1329

WE BUILD TRACKS

Design—Construction—Rehabilitation

ENGEL & HEVENOR

Track Engineers—Contractors

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ELECTRICAL TESTING LABORATORIES
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80th Street and East End Ave., New York, N. Y.

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HYDRAULIC DEVELOPMENTS — ELECTRIC RAILWAYS

THE P. EDW. WISH SERVICE
Suite 1710 DETECTIVES *Suite* 1102
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When writing the advertiser for information or prices, a mention of the Electric Railway Journal would be appreciated.

KELLY, COOKE & COMPANY

Engineers

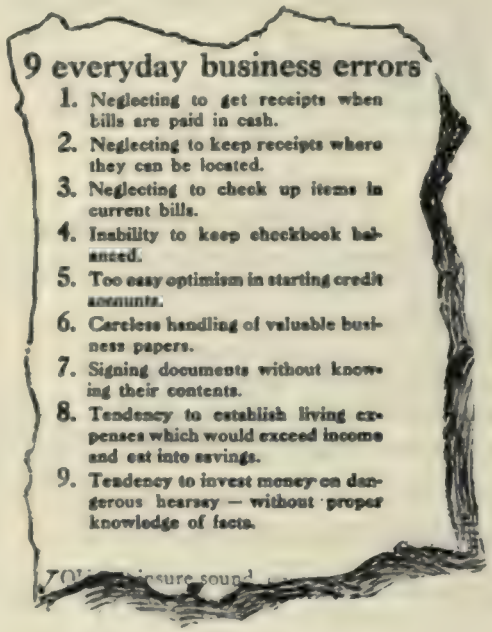
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—The TENTH Error

This clipping from a recent newspaper advertisement, tells a valuable story. But it overlooks one of the *biggest* business errors—

Neglecting to use the

SEARCHLIGHT SECTION

It is a bad business error to overlook the opportunities that this Department puts at your disposal.

Whether you wish to buy or to sell—to secure contracts—to reach the men whose services you want or to whom you wish to sell your services

—the "Searchlight" offers you the opportunity to reach the largest possible number of your prospective customers.

0086

Does Time Saving Mean Anything to You?

During the war a large electric railway system put into effect a well-considered "skip-stop" plan. The result was a benefit reflected in the schedules equivalent to the saving of 200 cars. A few months later that company was authorized to increase its rate of fare from 5 to 7 cents—which meant the handling of pennies. This fact caused such a slowing up of schedules that, according to the officials, all the benefits of the saving by "skip-stop" were lost.

In other words, the collection of those extra pennies from each passenger meant a deficiency in service equal to the loss of 200 *cars.*

In a recent advertisement we stated as one of the advantages of *metal tickets* that their use tends to decrease congestion in loading because change making is not required, and this decreases length of stop and makes for faster schedules; also permits conductors to give more attention to other duties.

We do not ask you to accept our word for this claim.

The statement has been made to us by many railway men who have used our metal tickets in connection with our registering fareboxes.

We will be pleased to give you a list of such references or to quote prices upon request.

Don't overlook this opportunity for bettering your service and increasing your revenues!

JOHNSON FARE BOX COMPANY

Jackson Boulevard and Robey Street, Chicago

50 East 42nd Street, New York



Car Space
Value is gauged
by Car Card Value



Maintains the Value of Both

Collier Service covers every nook and corner of the country so well that no matter how small or how large an advertiser is, service of the highest quality is rendered.

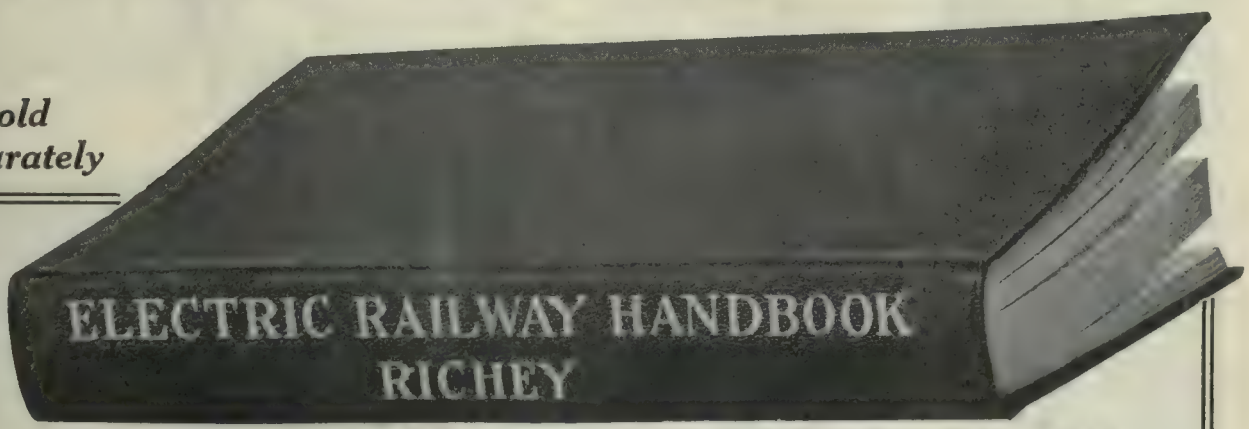
This means satisfied advertisers and it is only through the steady and uninterrupted support of satisfied advertisers that the stability of car space is maintained as a source of revenue to the railway company.



Candler Building, New York

EXAMINE ANY ONE OF THESE GREAT TIME SAVERS FOR TEN DAYS FREE

Sold Separately



1. *Richey's* Electric Railway Handbook

832 pages, pocket size, flexible binding. Over 600 illustrations — $4.00 net, postpaid

A pocket encyclopedia of practical, worth-while information on electric railway work.

There is no need to search through a number of reference books when you have Richey—it contains the data, formulae and tables that are constantly required. It will help overcome those problems that daily confront you. It is indispensable to operating and maintenance men.

Keep a copy of this book in your pocket—it means a better day's work.

2. *Blake and Jackson's* Electric Railway Transportation

487 pages, 6 x 9 Illustrated — $5.00 net, postpaid

The first book to cover the transportation side of the electric railway business—getting the cars over the tracks; increasing the traffic; collecting the fares. The authors have had exceptional opportunities to study the recent developments in transportation methods. The most important new methods are described, and their effects on earnings are shown.

3. *Jackson and McGrath's* Street Railway Fares

169 pages, 6 x 9 Illustrated — $2.50 net, postpaid

This book presents the data collected and conclusions reached in a research on electric railway traffic and fares, performed at the Massachusetts Institute of Technology. The data and conclusions are made especially clear by the use of tables and charts.

4. *Pease's* Freight Transportation on Trolley Lines

66 pages, 5 x 7½ Illustrated — $1.00 net, postpaid

Useful material bearing on the development of profitable freight business for trolley lines.

5. Practical Helps for Electric Railway Men

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Helpful articles for those who are responsible for the upkeep of the physical equipment of electrical railway properties make up this book. Overhead line construction, tracks, buildings, power plants, substations, shops and rolling stock and its equipment receive special attention.

The material is the work of well-known specialists. The information presented is of great value to engineers and technical men connected with the practical branches of electrical railway operation and maintenance.

CONTENTS: Part I.—Track and Structures. Part II.—Power Generation. Part III.—Power Transmission and Distribution. Part IV.—Car Design. Part V.—Car Equipment.

6. *Harding's* Electric Railway Engineering

416 pages, 6 x 9 Illustrated — $3.50 net, postpaid

Covers the principles of train operation, power generation and distribution, equipment and types of systems.

7. *Buck's* The Electric Railway

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You know the old story.

A nail missing in the shoe of a general's horse kept the general from reaching the battlefield in time.

Result: Loss of the battle and a kingdom.

We can't imagine a better story that brings out so clearly the commanding importance of little things. It's

For Want of Boyerized Pins and Bushings

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Result: Lost revenue miles, unsatisfactory service, failure of brakes to work when most needed.

The slightly higher price that you pay for Boyerized Pins and Bushings is a mighty modest premium indeed for the insurance that they give you. It will pay you many times over in *safety alone* to keep your brake-rigging well-shod as it were!

Remember that Boyerized Pins and Bushings differ widely from the haphazard case-hardening of a blacksmith shop. They are made with specialized equipment and by specialized workmen to assure uniformity of excellence always.

To Boyerize means to lengthen the life of your equipment and to lower the cost of your upkeep.

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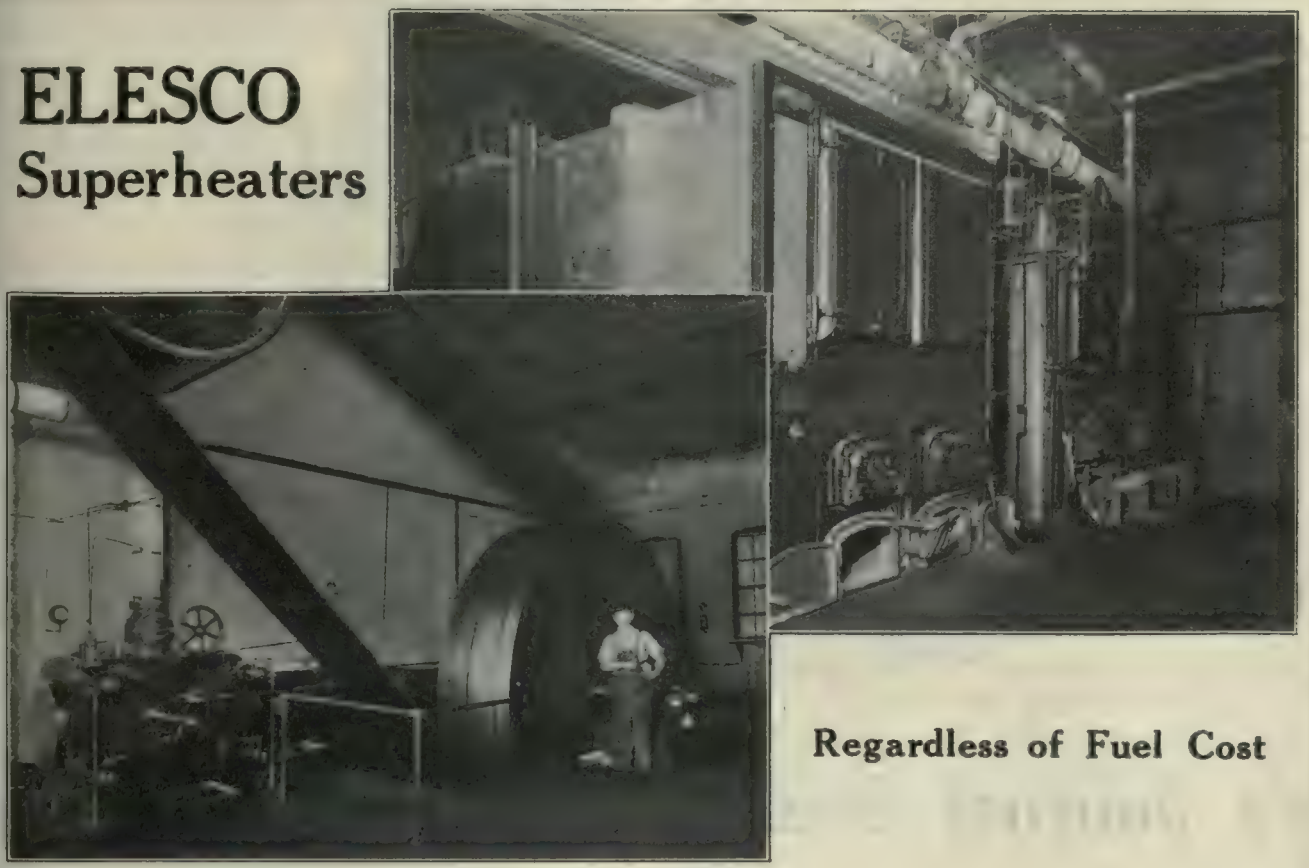
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Manganese Brake Heads
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Regardless of Fuel Cost

Render Economy in Every Plant

No matter what your fuel cost, even though it costs you nothing, the Elesco Method of Superheating pays. Instead of wet, lifeless steam, your engines or turbines **receive** an ample supply of superheated, power-plus steam.

Where fuel costs are high, the Elesco Superheater enables you to reduce its cost by burning less of it.

All your operating conditions will be improved when you equip with the Elesco.

Your steam supply will be adequate even under increased power demands. Your piping and engines will be protected from the danger of water hammer. Turbine blade wear will be greatly reduced and reblading necessary only after much longer periods of operation. These advantages result in lower operating and maintenance costs.

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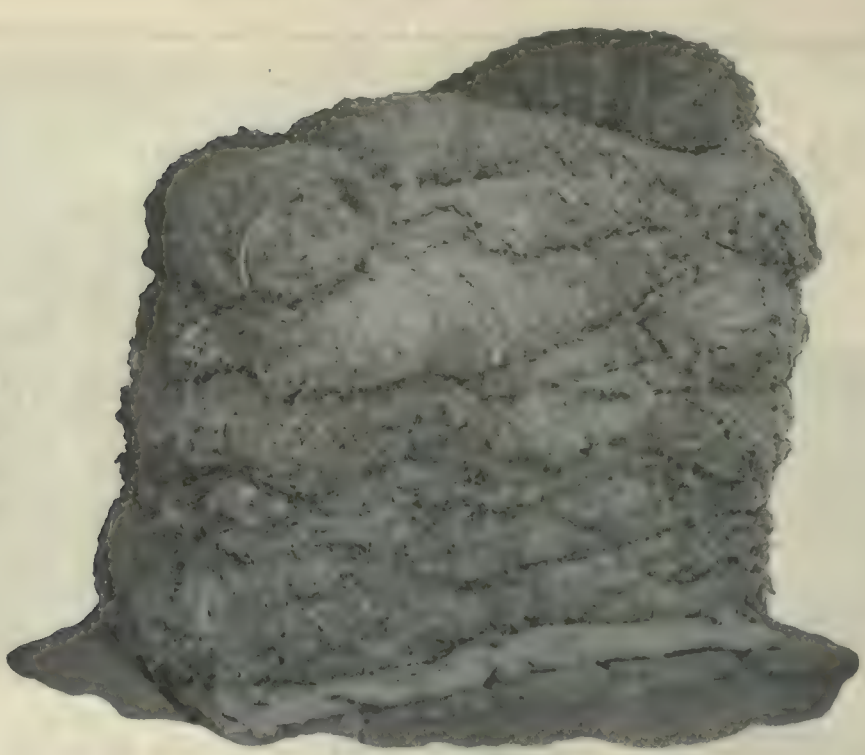
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E-3-13



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THE above picture shows a bale of our product all ready for use. We call it *Franklin Perfection* because it is is as near perfection in the journal box packing as highly trained Engineers have been able to design.

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Franklin Perfection is made of such a consistency that it has the power of holding the correct quantity of oil evenly distributed through the threads of waste, which are able to carry the oil by wick action against the force of gravity, if necessary, to the threads in contact with the journal. At the same time it has the elasticity to always keep in contact with the journal and never get matty.

To use *Franklin Perfection* means to you the saving of hundreds of dollars a year through the eliminating of Hot Boxes alone.

We make no statements we can't prove and therefore if we can't save you money we don't want your business.

Why not give us a chance? It will pay you and if everything we say is not true it won't cost you a cent.

Write for details and samples

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Heavy Loads at High Speed

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The M. C. B. Grade "A" of the Metal World

A Proven Factor in Railroad Efficiency

upon which inter-state commerce depends to move crops and commodities to and fro.

Commerce thrives upon Time-to-the-Minute Service and one inferior bearing may demoralize time schedules for a day.

Cyprus Bronze Railway Journal Bearings and Engine Castings are made for Time-to-the-Minute Service. They are cast of metal that stands the strain and eliminates the friction.

We developed the Original Formula—High in Lead and Low in Tin contents—after a railroad experience of two score years and more.

High Speed Motor Bearings

Equally as essential to Regular Service and Safety. Another product of **Cyprus Bronze** Metal.

The demonstration of the value rendered by **Cyprus Bronze** Metal is attested by its use wherever Railways are operating. *World Wide Testimony From World Wide Experts.*

While discussing Regularity of Train Service, we call attention to

Brady Battery Zincs

For Railway Signals. A signal which fails to work for "lack of battery" brings to halt miles of traffic. Our Battery Zincs are made right, by the right men, of Virgin Spelter. Battery power high, with no signal failures, because zinc defects which develop internal resistance, are eliminated. Brady Zincs make tower operators cheerful and confident.

High Grade Castings

Produced by us to our own formulas or to any the buyer may specify. 15,000 Patterns in our Storage Vaults—a sight in itself! If none meets your need, we furnish new at cost.

Trunk line and water shipping facilities at our very door. That means Promptness, a Saving to our Customers and to Us.

"All Quotations for Immediate Acceptance."

Brady Brass Company

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170-182 Fourteenth St., and 169-175 Fifteenth St.
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CYPRUS BRONZE

FROM 0.0005 POUND TO 400,000 POUNDS

A fine wire nail weighing 1-2000 pound and a gigantic steel casting weighing 200 tons represent two extremes which clearly convey an idea of the wide range of steel products manufactured by us. We'll be glad to send you a copy of our ***"List of Steel and Other Products,"*** which itemizes nearly everything that our plants make, such as

- Alloy and Tool Steels
- Agricultural Steels
- Armor Plate
- Axles
- Bar Steel of Every Description
- Boiler Plates, Manholes and Hand Holes
- Charcoal Iron and Steel Boiler Tubes
- Cold Rolled and Cold-Drawn Steel
- Crank Pins and Piston Rods
- Forgings of All Kinds
- Heavy Forgings a Specialty
- Forged and Rolled Discs and Annular Sections Weighing 100 Pounds or more.
- Locomotive and Car Wheel Tires
- Ordnance
- Plow Steel
- Pressed Steel Seats for Agricultural Implements
- Projectiles
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Series Number 26-1

HEAVY FORGINGS

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Center Plates
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Steel Tires

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Solid Rolled Steel Wheels

O. H. Steel and Malleable Iron Castings

Solid Forged Gear Blanks

Steel Forgings Iron Forgings

Forged and Rolled Steel

Pipe Flanges

Ring Dies

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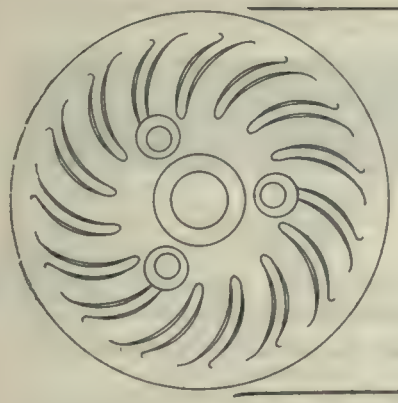
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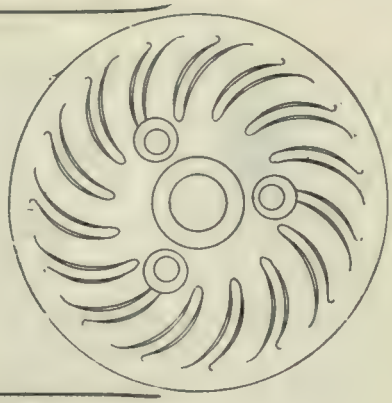
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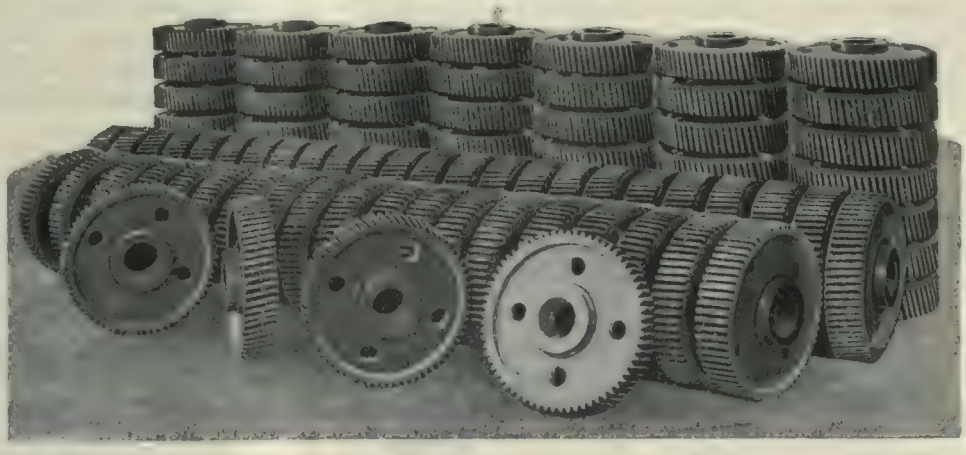
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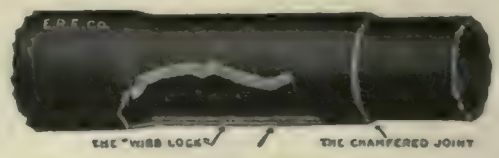
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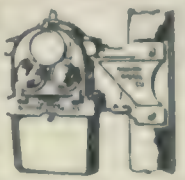
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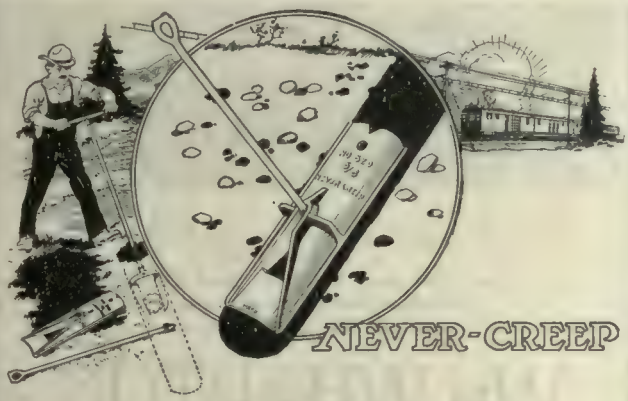


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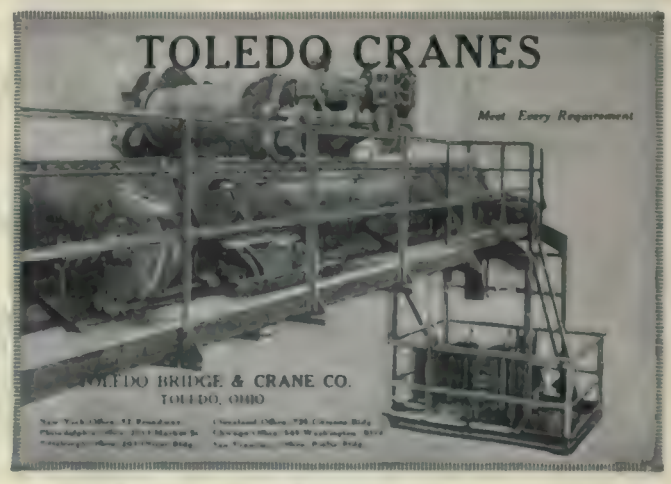


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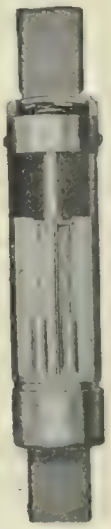


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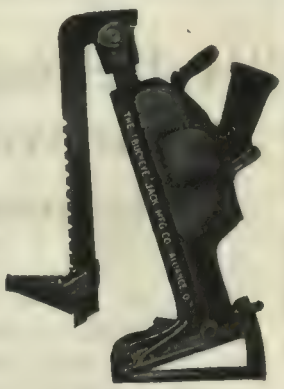
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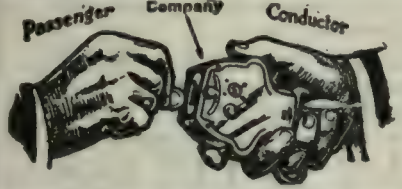


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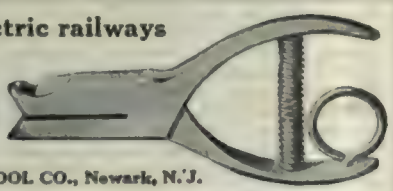


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The Cooper Heater Company
Carlisle, Pa.

SAMSON SPOT WATERPROOFED TROLLEY CORD



Trade Mark Reg. U. S. Pat. Off.
Made of extra quality stock firmly braided and smoothly finished. Carefully inspected and guaranteed free from flaws.
Samples and information gladly sent.
SAMSON CORDAGE WORKS, BOSTON, MASS.

Now the
ONE-MAN SAFETY CAR
has arrived, start right with

Standard Patterns Reinforced Brake Shoes

Pattern No. D-67, 2¼ inches to 2½ inches wheel treads; for narrow heads.

Pattern No. D-87, 2¾ inches to 3 inches wheel treads; for wide heads.

And use Solid End Plate Brake heads for Efficiency and Economy.

The American Brake Shoe and Foundry Company
30 Church Street, New York
332 S. Michigan Ave., Chicago Chattanooga, Tenn.



"V-K"
Oilless Trolley Wheel
does everything that any other type will do—and does it better.
The "V-K" does many things no other wheel can do—and does them efficiently.
Ask us about it.
More-Jones
Brass & Metal Co.
St. Louis, Mo.

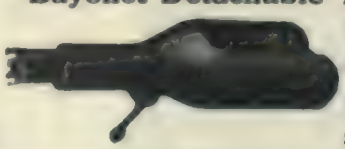


We specialize in the manufacture of
HIGH GRADE
BRUSHES *for* RAILWAY MOTORS
and all other types of electrical equipment. All brushes especially designed for the service in which they are to operate and satisfactory performance guaranteed.
Send for specification blanks
THE UNITED STATES GRAPHITE COMPANY
Saginaw, Michigan, U. S. A.
Branch Offices: New York, Pittsburgh, Philadelphia, Birmingham, Chicago, St. Louis, Denver, San Francisco

McGuire-Cummings Mfg. Company
General Offices—111 West Monroe St., CHICAGO
City and Interurban Cars and Trucks, Snow Sweepers and Plows,
Express, Combination and Work Cars, Electric Locomotives

B. A. Hegeman, Jr., President; Charles C. Castle, First Vice-President; Fred. C. J. Dell, Secretary; Harold A. Hegeman, Vice-President and Treasurer; W. C. Lincoln, Engineer.
National Railway Appliance Co.
50 East 42nd St., NEW YORK CITY
Hegeman-Castle Corporation, Chicago
National Railway Appliance Co., Washington, D. C.
RAILWAY SUPPLIES
Selling Agents for Tool Steel Gears and Pinions, Anderson Slack Adjusters, Genesee Paint Oils, Clapp Fire Resisting Paint, Dunham Hopper Door Device, Feasible Drop Brake Staff, Anglo-American Varnish Paints, Enamels, Surfacer and Shop Cleaner, Johnson Fare Boxes, Perry Side Bearings, Miller Trolley Shoes, Hartman Centering Centre Plates, One Man Kerosene Furnaces, Economy Power Saving Meters, Jewel Street Car Heaters, H. & W. Electric Heaters, Garland Ventilators, National Safety Car Equipment Company's One Man Cars, Pitt Sanders.

Bayonet Detachable Trolley Harps



save time, labor, wheels, wire, power, money; keep your cars on schedule time, prevent accidents. Satisfaction guaranteed.
BAYONET TROLLEY HARP CO.
Springfield, O., U. S. A.

THE MOST SUCCESSFUL MEN IN THE ELECTRIC RAILWAY INDUSTRY READ THE
ELECTRIC RAILWAY JOURNAL
EVERY WEEK

DREW MOTORMEN'S SAFETY MIRRORS
Eliminate Accidents
Send for catalogue No. 18
DREW ELECTRIC & MFG. CO.
Collamer Ave. and Nickel Plate Railroad, Cleveland, O.



RAILWAY UTILITY COMPANY
Sole Manufacturers
"HONEYCOMB" AND "ROUND JET" VENTILATORS
for Monitor and Arch Roof Cars and all classes of buildings;
also ELECTRIC THERMOMETER CONTROL
of Car Temperatures
141-151 WEST 22D ST. Chicago, Ill. *Write for Catalogue* 1328 BROADWAY New York, N. Y.

SEARCHLIGHT SECTION

POSITIONS VACANT

8 cents a word; minimum charge $2.00 an insertion.

POSITIONS WANTED

4 cents a word; mimimum charge 75 cents an insertion payable in advance.

ADVERTISING RATES

ELECTRIC RAILWAY JOURNAL

Count 5 words for box number if replies are in care of any of our offices; no additional charge for remailing; 10% discount for one payment in advance for 4 consecutive insertions of undisplayed ads.

MISCELLANEOUS

For Sale, For Rent, Wanted, Business Opportunity, Agents, Representatives and other advertisements: 8 cents a word; minimum charge $2.00 an insertion; (Evening Work and Tutoring ads at 4 cents a word, minimum charge 75 cents an insertion payable in advance).

DISPLAY ADS:—1 in.-$4.50; 4 in.-$4.30 an inch; 8 in.-$4.60 an inch; 15 in.-$3.90 an inch; 30 in. (one page)-$3.70 an inch.

POSITIONS VACANT

EMPLOYMENT

POSITIONS WANTED

POSITIONS VACANT

CAR barn foreman wanted for road operating 10 to 15 cars. Should be familiar with G. E. equipment and Westinghouse Air Brake equipment. State age, experience, references and salary expected. P-599, Elec. Ry. Journal.

ELECTRICAL repairman wanted One familiar with overhauling and repairing K type controllers, circuit breakers, rheostats, brush holdes, etc. State experience fully and salary exepected. Apply to Master Mechanic, Saginaw Bay City Railway Company, Saginaw, Mich.

ELECTRICAL draftsman for designing, detailing and layouts in connection with electrical installations in stations and substations. Reply giving age, education, experience and salary desired to Mr. H. A. Seymour, Commonwealth Edison Company, Chicago, Ill.

HIGH class civil engineer wanted by company planning large developments in South. Must have electric railway location and construction experience. Address Room 220, Citizens Bank Bldg., Norfolk, Va.

JUNIOR electrical engineers, $1501—$1800. per annum for assignment to inspection of subway, elevated and street railway power houses, equipment and rolling stock. Open to those with three years' acceptable experience in electric railroading and the manufacture and installation of electrical or mechanical apparatus and to graduates in electrical engineering. A number of provisional appointments being made pending examination. Open to citizens only. Age limit 21 to 30 years. Apply to Office of Transit Construction Commissioner, Room 1195, 49 Lafayette Street, New York City.

POSITIONS WANTED

ENGINEER, 32 years of age, 10 years' experience in charge of city and interurban track construction and maintenance, desires position as chief engineer or engineer of maintenance with up-to-date property. Minimum salary $3,600. Available April 1. PW-596, Elec. Ry. Journal, Old Colony Bldg., Chicago. Norfolk, Va.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad. and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
533 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
531 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies.

POSITIONS WANTED

MAN, 14 years' experience with large street railway, light, power and gas properties as accountant, assistant to general manager, secretary, treasurer and auditor solicits change. Age 40; large of statue, physically sound with good personality. A-1 references. Address PW-601, Elec. Ry. Journal.

SUPERINTENDENT, age 35, eighteen years' experience, transportation, mechanical and power efficiency on road operating interurban, surburban and city lines. Address PW-597, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

EVENING WORK WANTED

OPERATING statistics, new business possibilities and rate data prepared and analyzed. Accounts prepared and audited. EWW-602, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia, Penn.

FOR SALE

Rotary Converters

2 150 KW. Gen. Elec., type TC4A, rotary converters, 3-phase, 25 cycle, 373 v. a. c to 600 v. 250 amp. d. c.; each with 3-60 KW. type H 25 cycle 6600-375 v. oil-cooled indoor type transformers; also both a. c. and d. c. control panels with instruments, speed 750; all in fine condition, immediate shipment. Gregory Electric Co., 16th & Lincoln St., Chicago.

WANTED

Four 101-B Westinghouse railway type second-hand

ARMATURES

either complete with windings or without windings.

Notify S. J. WITT, Master Mechanic, West Penn Rys. Co., Connellsville, Pa.

Your Advancement

is largely in your own hands—it is doubtful if any one else is worrying over it.

Better positions are constantly being secured through small advertisements in the "Positions Wanted" columns.

80 CENTS FOR 20 WORDS

WORRYLESS ELECTRICAL REPAIRS

On all kinds and sizes A.C. or D.C. motors and generators, starters, welders, controllers, or anything electrical. Quick shipment from stock material, of coils commutators—shafts—bearings, etc. Remember our initials stand for our product.

CAREFUL CLEVELAND ACCURATE ARMATURE WORRYLESS WORKS, Inc.

EST. 1895 4732-4-6 ST. CLAIR AVE., CLEVELAND INC. 1918

RAILS IN STOCK

IMMEDIATE SHIPMENT

GUARANTEED

10,000 Tons New 12-lb. to 100-lb., and fastenings.
40,000 Tons New Open-hearth, first quality, 80 lb.
5,000 Tons Relayers, 25 to 100 lb., and fastenings.
Car and less carload inquiries and orders solicited.
Rails cut to lengths for all purposes.

TRACK ACCESSORIES
BOLTS, NUTS AND SPIKES

We Manufacture
FROGS, SWITCHES, CROSSINGS, PORTABLE TRACK, DUMP CARS, PLATFORM CARS, ETC.

L. B. FOSTER COMPANY
Park Building, Pittsburgh, Pa.
Tribune Building, 154 Nassau St., New York, N. Y.

Machinery in Stock for Immediate Shipment

ROTARY CONVERTERS—60-CYCLE
2—300 kw., Westg., 3-phase, 370-v., A.C., 575-v., D. C., 600 r.p.m.
1—150 kw., Westg., 2- or 3-phase, 185-v., A.C., 250-v., D.C., 720 r.p.m.

FREQUENCY CHANGER SET
1—600 kva., Allis-Chalmers Frequency Changer Set, 300 r.p.m., 3-phase, 60-cycle, 2300-v. one end, 3-phase, 6600-v., 25-cycle on other end.

ARCHER & BALDWIN, INC.
114-116 Liberty Street, New York City
Telephone, 4337-4338 Rector

Advertisements for the
Searchlight Section



Can be received at the New York Office of Electric Railway Journal until 10 a.m.

Thursday

For Issue out Saturday

0141

FOR SALE
4—Center Entrance, All-Steel Cars, Plain Arch Roof, 35 ft. over bumpers, Taylor Double Trucks.
2—G.E. 247-A Box Frame Motors.
2—K-10-P Controllers.
Complete. Splendid Condition. Full details upon request.
ELECTRIC EQUIPMENT COMPANY
Commonwealth Bldg., Philadelphia, Pa.

FOR SALE
FIVE
Open Trailers
FOUR
Motor Cars
For full particulars write
C. J. SWIFT
Highwood, Illinois

Caution—RAIL USERS

If you contemplate needing more track during 1920, BUY NOW. There will be a SCARCITY. We own and offer the following NEW RAILS for prompt shipment:

16-lb. Rails, angle bars, bolts and nuts
25-lb. Rails, angle bars, bolts and nuts
80-lb. Rails, angle bars, bolts, nuts and spikes
85-lb. Rails, angle bars, bolts, nuts and spikes
90-lb. Rails, angle bars, bolts, nuts and spikes
100-lb. Rails, angle bars, bolts, nuts and spikes

They will be gone soon. Write or wire for our quotations.

HYMAN-MICHAELS COMPANY
531 Peoples Gas Bldg., Chicago

BRANCH OFFICES: First National Bank Bldg., Pittsburgh, Pa.; Railway Exchange Bldg., St. Louis, Mo.; East Chicago, Ind.
YARDS AND WAREHOUSES: East Chicago, Ind. and St. Louis, Mo.

CARS FOR SALE
2—McKeen Gaso-Electric Cars.
12—Differential 20-yd. Cars.
5—Gasoline Passenger Cars
50—Freight Cars.
12—Electric Cars.
Get our List and Prices.
J. F. DONAHOO CO., Birmingham, Ala.

FOR SALE
BOILERS
2—500 H.P. B. & W. Boilers in fair condition, water tube.
DALLAS ICE FACTORY,
Cor. Swiss and Hall, Dallas, Tex.

SEARCHLIGHT SERVICE SECURES SATISFACTORY SITUATIONS
2003

Electric Railway for Sale!

We have purchased the entire equipment of the Cincinnati & Columbus Traction Co., which was operated from Norwood to Hillsboro, O., a distance of approximately 53 miles, and offer for sale the following:

RAILS—

5000 tons No. 1, 70-lb. relaying steel rails.

WIRE—

500,000 lb. or more of copper trolley, feeder, high tension, etc.

POWER EQUIPMENT—

6 Babcock & Wilcox boilers, 165-lb. pressure, equipped with American stokers, forced and induced draft, and economizers.
Corliss Engines.
Generators.
Switchboards and Transformers.
Rotary Converters.

ROLLING STOCK (Standard Gauge)—

5 Box Cars, no motors.
3 Flat Cars, no motors.
1 Derrick Car, no motors.
5 Gondolas, no motors.
3 Gondola Cars, no motors, center dump.

Write or wire us, stating just what you are interested in, and we will be pleased to submit quotations and further particulars.

HYMAN-MICHAELS COMPANY

(Refer to Department J)

People's Gas Building, Chicago, Ill.

Branches: New York City—Pittsburgh—St. Louis

War Department

CORPS OF ENGINEERS

Offers for Sale by Informal B

STEEL RAIL and

Here are the Conditions of Sale

ALL material will be sold "as is," F.O.B. storage point. All material listed is unused. It is in open storage. Analysis of the steel cannot be given. It was originally inspected for the Government by R. W. Hunt & Co., and by the Pittsburgh Testing Laboratory. It may be inspected by authorized representative of the prospective bidder upon application to the officer in charge at points of storage. Quantities shown are approximate only.

Bids may be for the entire lot, or for the entire quantity at each separate storage point, or for the entire lot of each class of material, or for the listed quantity of each class of material at each separate storage point. *No special form of bid is required.* Bids may be made by letter or telegram.

In making bids for Rail, state price offered per gross ton; for Splice Bars, per pair; for Bolts and Nuts, Spikes, Tie-plates, per cwt.; for Rail Braces, Railroad Crossings, Re-railers, each. Delivery will begin within a short time after completion of contract. The Item Number as given in this advertisement must be specified for each item upon which bids are made.

All bids must be in *office, Chief of Engineers, Room* 2706, *Munitions Building, Washington, D. C., not later than* 4:30 *P. M., Eastern Time, March* 29, 1920. The right is reserved to reject any or all bids.

Successful bidders, immediately upon notification of award, will be required to furnish a certified check for 20% of the full amount due. Complete shipping instructions must be furnished within 30 days of notification of award. Further particulars and information may be obtained upon application to the *Office, Chief of Engineers, Room* 2706, *Munitions Building, Washington, D. C.*

Item E 101

67.53-POUND RUSSIAN RAIL—STANDARD LENGTHS

Approximately 1,333 gross tons.

Location:

520 gross tons at Norfolk, Va.
813 gross tons at Kearny, N. J.

For splice bars, track bolts and nuts for this rail, see Items E 107 and E 110

Item E 102

35-POUND A. S. C. RAILS—15 FT. LENGTHS—UNDRILLED

Approximately 1,091 gross tons, no accessories. Made of "shell discard" steel.

Location:

57 gross tons at Norfolk, Va.
825 gross tons at Kearny, N. J.
90 gross tons at Port Newark, N. J.
119 gross tons at Philadelphia, Pa. (21st St. and Oregon Ave.)

Item E 103

30-POUND A. S. C. E. RAIL—26 FT. LENGTHS—DRILLED

Approximately 1,101 gross tons, no accessories.

Location:

Kearny, N. J.

Item E 104

25-POUND A. S. C. E. RAIL—UNDRILLED

Approximately 2,946 gross tons, lengths of 8, 10 and 12 ft. No accessories. Made of "shell discard" steel.

Location:

195 gross tons at Norfolk, Va.
2,571 gross tons at Kearny, N. J.
7 gross tons at Port Newark, N. J.
49 gross tons at New Cumberland, Pa. (near Harrisburg).
124 gross tons at Philadelphia, Pa. (21st St. and Oregon Ave.)

NOTE:—Items E-102 and E-104 were purchased for use as trench supports and for other military construction purposes.

War Department

CORPS OF ENGINEERS

Railroad & Construction Material

TRACK ACCESSORIES

Item E 105

RE-RAILERS
Total quantity, 3,200.
Location:
1,248 at Kearny, N. J.
1,925 at Schenectady, N. Y.

Item E 106

SPLICE BARS
(For 80 lb. A.R.A. Type "B" Rail)
Weight per pair about 48 lbs.
Total quantity, 86,900 pairs.
Location:
84,407 pairs at Norfolk, Va.
1,955 pairs at Port Newark, N. J.
538 pairs at Schenectady, N. Y.

Item E 107

SPLICE BARS
(For 67.53 lb. Russian Rail)
Weight per pair about 49 lbs.
Total quantity, 26,728 pairs.
Location:
Kearny, N. J.

Item E 108

SPLICE BARS
(For 50 lb. A.S.C.E. Rail)
Weight per pair about 26 lb.
Total quantity, 3,500 pairs.
Location:
Port Newark, N. J.

Item E 109

TRACK BOLTS AND NUTS ⅞ in. x 4¼ in.
(For 80 lb. A.R.A. Type "B" Rail)
Total quantity, 4,029 Kegs (200 lb. each)
Location:
3,182 Kegs at Norfolk, Va.
546 Kegs at Kearny, N. J.
301 Kegs at New Cumberland, Pa.

Item E 110

TRACK BOLTS AND NUTS
(For 67.53 lb. Russian Rail)
Total quantity, 745 boxes (180 lb. each)
Location:
303 Boxes at 21st and Oregon Ave., Philadelphia, Pa.
442 Boxes at U. S. Arsenal, Pittsburgh, Pa.

Item E 111

TRACK SPIKES (⅝ in x 5 in.)
(For 40 lb. A.S.C.E. Rail)
Total quantity, 625 Kegs (200 lb. each)
Location:
Kearny, N. J.

Item E 112

TIE PLATES (6½ in. x 10 in.)
(For 80 lb. A.R.A. Type "B" Rail)
Total quantity, 75,560 pieces.
Location:
41,124 pieces at Norfolk, Va.
33,890 pieces at Kearny, N. J.
546 pieces at 21st and Oregon Ave., Philadelphia, Pa.

Item E 113

RAIL BRACES
(For 80 lb. A.R.A. Type "B" Rail)
Total quantity, 152,988.
Location:
86,208 Braces at Norfolk, Va.
27,320 Braces at Kearny, N. J.
39,460 Braces at Chicago, Ill.

Item E 114

RAILROAD CROSSINGS (4 ft. 8 11/16 in. GAUGE)
(80 lb. A.R.A. Type "B" Rail)
Angles of 45, 60, 75, and 90 degrees.
Total quantity, 32.
Location:
2-90 degree at Kearny, N. J.
10-75; 10-60; 10-45; deg. at Norfolk, Va.

Item E 115

RAILROAD CROSSINGS (4 ft. 8½ in. GAUGE)
(80 lb. A.R.A. Type "B" Rail)
Angles of 45, 60 and 75 degrees.
Total quantity, 48.
Location:
16-45 degree at Kearny, N. J.
20-75; 12-60 degrees at Norfolk, Va.

Item E 116

RAILROAD CROSSINGS (4 ft. 8 11/16 in. GAUGE)
(80 lb. A.R.A. Type "B" Rail)
Angles of 45, 60 and 90 degrees.
Total quantity, 20.
Location:
9-60; 3-45 degree at Kearny, N. J.
8-90 degree at Norfolk, Va.

Item E 117

RAILROAD CROSSINGS (4 ft. 8 11/16 in. GAUGE)
(67.53 lb. Russian Rail)
Angles of 30, 45, 60, 75, and 90 degrees.
Total quantity, 40.
Location:
Kearny, N. J.

The War Department, Corps of Engineers, is also offering for Sale **Locomotive Cranes** of leading makes. Information about these cranes may be obtained from Office of Chief of Engineers, Room 2706 Munitions Building, Washington, D. C.

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

Advertising, Street Car
Collier, Inc., Barron G.

Air Aftercoolers
Ingersoll-Rand Co.

Air Receivers
Ingersoll-Rand Co.

Air Rectifiers
Holden & White, Inc

Ammeters
Weston Elec'l Instrument Co.

Anchors, Guy
Chance Co., The.
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse Elec. & M. Co.

Angle Bars
Lackawanna Steel Co.

Ash Storage Tanks, Cast Iron
Green Engineering Company

Automobiles and Buses
Brill Co., The J. G.

Axle Straighteners
Columbia M. W. & M. I. Co.

Axles, Car Wheel
Bemis Car Truck Co.
Brill Co., The J. G.
Cambria Steel Co.
Carnegie Steel Co.
Midvale Steel & Ordnance Co
St. Louis Car Co.
Standard Steel Works Co.
Westinghouse Elec. & M. Co.

Babbitt Metal
More-Jones Brass & Metal Co.

Babbitting Devices
Columbia M. W. & M. I. Co.

Badges and Buttons
Electric Service Supplies Co.
International Register Co., The

Batteries, Storage
Electric Storage Battery Co.

Bearings and Bearing Metals
Bemis Car Truck Co.
Brady Brass Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
More-Jones Brass & Metal Co.
St. Louis Car Co.
Westinghouse Elec. & M. Co.

Bearings, Center and Roller Side
Holden & White, Inc.
Stucki Co A

Bearings, Roller & Ball
Gurney Ball Bearing Co

Bells and Gongs
Brill Co The J. G.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
St. Louis Car Co.

Benders, Rail
Niles-Bement-Pond Co.
Wharton Jr. & Co., Wm.
Zelnicker, Walter A., Supply Co., Inc.

Bollers
Babcock & Wilcox Co.

Boiler Tubes
National Tube Co.

Bond Testers
American Steel & Wire Co
Rail Welding & Bonding Co.

Bonding Apparatus
American Steel & Wire Co.
Electric Railway Improv. Co
Electric Service Supplies Co.
Ohio Brass Co.
Rail Welding & Bonding Co.

Bonds, Rail
Electric Railway Improv. Co.
Electric Service Supplies Co.
General Electric Co
Ohio Brass Co.
Rail Welding & Bonding Co
Westinghouse Elec. & M Co.

Book Publishers
McGraw-Hill Book Co., Inc.

Boring Tools, Car Wheel
Niles-Bement-Pond Co.

Brackets and Cross Arms. (See also Poles, Ties, Posts, Etc.)
Bates Expanded Steel Truss Co
Electric Railway Equipment Co
Electric Service Supplies Co.
Hubbard & Co.
Lindsley Bros. Co.
Ohio Brass Co.

Brake Adjusters
Holden & White, Inc.
National Ry. Appliance Co.
Westinghouse Traction Brake Co.

Brake Shoes
Amer. Brake Shoe & Fdry. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
St. Louis Car Co.

Brakes, Brake Systems and Brake Parts
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
General Electric Co.
Holden & White, Inc.
National Brake Co.
St. Louis Car Co.
Safety Car Devices Co.
Westinghouse Traction Brake Co.

Bricks, Fire
Green Engineering Co.

Brooms, Track, Steel or Rattan
Paxson Co., J. W.
Zelnicker, Walter A., Supply Co., Inc.

Brushes, Carbon
General Electric Co.
Jeandron, W. J.
United States Graphite Co.
Westinghouse Elec. & M. Co.

Brushes, Graphite
United States Graphite Co.

Brush Holders
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.

Bushings, Case Hardened and Manganese
Bemis Car Truck Co.

Bushings, Graphite and Wooden
Bound Brook Oilless Bearing Co.

Cables. (See Wires and Cables)

Carbon Brushes. (See Brushes, Carbon)

Car Equipment. (For Fenders, Heaters, Registers, Wheels, etc., see those headings)

Car Trimmings. (For Curtains, Registers, Doors, Seats, etc., see those headings)

Car Panel Safety Switches
Westinghouse Elec. & Mfg. Co.

Cars, Passenger, Freight, Express, etc.
American Car Co.
Brill Co., The J. G.
Cambria Steel Co.
Kuhlman Car Co., G. C.
McGuire-Cummings Mfg. Co.
Midvale Steel & Ordnance Co.
National Ry. Appliance Co.
St. Louis Car Co.
Wason Mfg. Co.

Cars, Second Hand
Electric Equipment Co.

Car, Self-Propelled
Electric Storage Battery Co.
General Electric Co

Castings, Brass, Composition or Copper
Anderson Mfg. Co. A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co
More-Jones Brass & Metal Co.

Castings, Gray Iron and Steel
American Steel Foundries
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Standard Steel Works Co.
Wharton Jr. & Co., Wm.

Castings, Malleable and Brass
Amer. Brake Shoe & Fdry. Co
Bemis Car Truck Co.
Columbia M. W. & M. I. Co
St. Louis Car Co.

Catchers and Retrievers, Trolley
Electric Service Supplies Co
Holden & White, Inc.
Ohio Brass Co.
Wood Co., Chas. N

Circuit Breakers
Automatic Reclosing Circuit Breaker Co.
Cutter Electrical & Mfg. Co., The
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps and Connectors for Wires and Cables
Anderson Mfg. Co., A. & J. M.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Cleaners and Scrapers—Track (See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.
Ohio Brass Co.

Clusters and Sockets
General Electric Co

Coal and Ash Handling. (See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Coils, Armature and Field
Cleveland Armature Works
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Rome Wire Co.
Westinghouse Elec. & M. Co.

Coils, Choke and Kicking
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Coin-Counting Machines
Electric Service Supplies Co.
International Register Co., The
Johnson Fare Box Co.

Comelong
Bush Electric Co.

Commutator Slotters
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Commutator Truing Devices
General Electric Co.

Commutator or Parts
Cameron Electrical Mfg. Co.
Cleveland Armature Works
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Compressors, Air
Chicago Pneumatic Tool Co.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Trac. Brake Co.

Compressors, Gas
Ingersoll-Rand Co

Condensers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Conduit Fittings
Chicago Fuse Mfg. Co.

Connectors, Solderless
Frankel Connector Co.
Westinghouse Elec. & Mfg. Co.

Controller Fingers
Russell Mfg. Co.

Controllers or Parts
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co
Russell Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Controller Regulators
Elec. Service Supplies Co

Controlling Systems
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Converters, Rotary
General Electric Co
Westinghouse Elec. & Mfg Co

Conveyors, Belt
Portable Machinery Co.

Conveyors, Coal and Ash
Green Eng. Co.
Portable Machinery Co.

Conveyors, Portable
Portable Machinery Co.

Conveying and Hoisting Machinery
Columbia M. W. & M. I. Co.
Green Eng. Co.
Portable Machinery Co.

Copper Wire
Anaconda Copper Mining Co.

Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Roebling's Sons Co., John A.
Samson Cordage Works

Cord Connectors and Couplers
Electric Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.

Couplers, Car
Brill Co., The J. G.
Ohio Brass Co.
Van Dorn Coupler Co.
Westinghouse Trac. Brake Co.

Cranes
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The

Creosoting. (See Wood Preservatives)

Cross Arms. (See Brackets)

Crossing Foundations
International Steel Tie Co.

Crossing Signals. (See Signals, Crossing)

Crossings, Track. (See Track, Special Work)

Culverts
Canton Culvert & Silo Co.

Curtains and Curtain Fixtures
Brill Co., The J. G.
Electric Service Supplies Co.
St. Louis Car Co.

Cutouts
Chicago Fuse Mfg. Co.

Dealers' Machinery
Archer & Baldwin
Cleveland Armature Works
Electric Equipment Co.
Foster Co., L. B.
Griswold Machine Co., Geo. M.
Hyman Michaels Co.
MacGovern & Co., Inc.
Zelnicker Supply Co., Inc., Walter A.

Derailing Devices. (See also Track Work)
Cleveland Frog & Crossing Co.
Wharton Jr. & Co., Wm.

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Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Detective Service
Wish Service P. Edward

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Williams & Co., J. H.

Door Operating Devices
Consolidated Car Heating Co.
National Pneumatic Co., Inc.
Safety Car Devices Co.

Doors and Door Fixtures
Brill Co., The J. G.
General Electric Co.
Hale & Kilburn Corp.

Doors, Folding Vestibule
National Pneumatic Co., Inc.

Draft Rigging. (See Couplers)

Drills, Rock
Ingersoll-Rand Co.

Drills, Track
American Steel & Wire Co.
Chicago Pneumatic Tool Co.
Electric Service Supplies Co
Niles-Bement-Pond Co.
Ohio Brass Co.

Drinking Cups, Sanitary Paper
Individual Drinking Cup Co., Inc.

Dryers, Sand
Electric Service Supplies Co.
Zelnicker Supply Co., Inc., Walter A.

Electrical Wires and Cables
Roebling's Sons Co., J. A.

Engineers, Consulting, Contracting and Operating
Archbold Brady Co.
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Ford Bacon & Davis
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Republic Engineers, Inc.
Richey, Albert S.
Robinson & Co., Dwight P.
Sanderson & Porter
Scofield Engineering Co.
Stone & Webster
White Companies, The J. G.
Woodmansee & Davidson Engineering Co.

Engines, Gas and Oil
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Engines, Steam
Westinghouse Elec. & Mfg. Co.

Fare Boxes
Brill Co., The J. G.
Cleveland Fare Box Co.
Johnson Fare Box Co.
National Railway Appliance Co.

Fences, Woven Wire and Fence Posts
American Steel & Wire Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Cleveland Fare Box Co.
Consolidated Car Fender Co.
Electric Service Supplies Co.
Star Brass Works

Fibre and Fibre Tubing
Westinghouse Elec. & Mfg. Co.

Field Coils. (See Coils)

Filters, Water
Scaife & Sons Co., Wm. B.

Fire Extinguishing Apparatus
Castle, Inc., James M.

Floodlights
Electric Service Supplies Co.

Flooring Composition
American Mason Safety Thread Co.

Flooring, Grating
Irving Iron Works

Forgings
Carnegie Steel Co.
Columbia Machine Works & M. I. Co.
Eureka Co.
Standard Forgings Co.
Standard Steel Works Co.
Williams & Co., J. H.

Frogs, Track. (See Track Work)

Furnaces. (See Stokers)

Fuses and Fuse Boxes
Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Multiple Electric Products Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co., J. W.

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Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
General Electric Co.

Fuse, Removers
Bush Electric Co.

Gages, Oil and Water
Ohio Brass Co.

Gaskets
Power Specialty Co.
Westinghouse Traction Brake Co.

Gas-Electric Cars
General Electric Co.

Gas Producers
Westinghouse Elec. & Mfg. Co.

Gates, Car
Brill Co., The J. G.

Gear Blanks
Carnegie Steel Co.
Standard Steel Works Co.

Gear Cases
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Westinghouse Elec. & Mfg. Co.

Gears and Pinions
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
National Railway Appliance Co.
Nuttall Co., R. D.
Tool Steel Gear & Pinion Co.

Generating Sets, Gas-Electric
General Electric Co.

Generators
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Gongs. (See Bells and Gongs)

Grates, Chain
Green Eng. Co.

WHAT AND WHERE TO BUY

Greases. (See Lubricants)

Grinders and Grinding Supplies
Indianapolis Switch & Frog Co.
Metal & Thermit Corp.
Railway Track-work Co.

Grinding Blocks and Wheels
Railway Track-work Co.

Guards, Trolley
Electric Service Supplies Co.
Ohio Brass Co.

Harps, Trolley
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Electric Service Supplies Co.
More-Jones B. & M. Co.
Nuttall Co., R. D.
Star Brass Works

Headlights
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
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Heaters, Car (Electric)
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
Holden & White, Inc.
National Ry. Appliance Co.
Smith Heater Co., Peter

Heaters, Car, Hot Air and Water
Cooper Heater Co.
Holden & White, Inc.
Smith Heater Co., Peter

Heaters, Car (Stove)
Electric Service Supplies Co.
Holden & White, Inc.
Smith Heater Co., Peter

Hoists and Lifts
Columbia M. W. & M. I. Co.
Ford-Chain Block Co.
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The

Hose
Ingersoll-Rand Co.

Hose, Bridges
Ohio Brass Co.

Hydraulic Machinery
Niles-Bement-Pond Co.

Inspection
Electrical Testing Lab's

Instruments, Measuring, Testing and Recording
Economy Electric Devices Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Insulating Cloth, Paper and Tape
Belden Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Insulations. (See also Paints)
Anderson M. Co., A. & J. M.
Electric Ry. Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Holden & White, Inc.
Mitchell-Rand Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Insulators. (See also Line Material)
Anderson M. Co., A. & J. M.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Insulator Pins
Electric Service Supplies Co.
Hubbard & Co.

Jacks. (See also Cranes, Hoists and Lifts)
Brill Co., The J. G.
Buckeye Jack Mfg. Co.
Columbia M. W. & M. I. Co.
Templeton, Kenly Co., Ltd.

Joints, Rail
Carnegie Steel Co.
Rail Joint Co.
Zelnicker Supply Company, Inc. Walter A.

Journal Boxes
Bemis Car Truck Co.
Brill Co., J. G.

Laboratories
Electric Testing Lab's

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Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Arc and Incandescent. (See also Headlights)
Anderson M. Co., A. & J. M.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Signal and Marker
Ohio Brass Co.

Lathe Attachments
Williams & Co., J. H.

Lathes, Car Wheel
Niles-Bement-Pond Co.

Lighting Regulators, Car
Holden & White, Inc.

Lightning Protection
Anderson M. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Line Material. (See also Brackets, Insulators, Wires, etc.)
Anderson M. Co., A. & J. M.
Archbold-Brady Co.
Chance Co., The
Columbia M. W. & M. I. Co.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Holden & White, Inc.
Hubbard & Co.
More-Jones B. & M. Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

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General Electric Co.
McGuire-Cummings Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Lubricating Engineers
Galena-Signal Oil Co.

Lumber. (See Poles, Ties, etc.)

Lubricants, Oil and Grease
Galena-Signal Oil Co.

Machine Tools
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Niles-Bement-Pond Co.

Machine Work
Columbia M. W. & M. I. Co.
Holden & White, Inc.

Meters, Car, Watt-Hour
Economy Electric Devices

Meters. (See Instruments)
Electric Service Supplies Co.

Mirrors for Motormen
Drew Elec. & Mfg. Co.

Motormen's Seats
Electric Service Supplies Co.
Wood Co., Chas. N.

Motors, Electric
Westinghouse Elec. & Mfg. Co.

Motors and Generators, Sets
General Electric Co.

Nuts and Bolts
Barbour-Stockwell Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Hubbard & Co.

Ohmmeters
Weston Elec'l Instrument Co.

Oils. (See Lubricants)

Oxy-Acetylene. (See Cutting Apparatus, Oxy-Acetylene)

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Westinghouse Traction Brake Co.

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Franklin Mfg. Co.

Paints and Varnishes (Insulating)
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Mitchell-Rand Mfg. Co.

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National Ry. Appliance Co.

Paving Material
American Brake Shoe & Fdry. Co.

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Electric Service Supplies Co.
Ohio Brass Co.

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Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
Wood Co., Chas. N.

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Bemis Car Truck Co.
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse Traction Brake Co.

Pipe
National Tube Co.

Pipe Fittings
Power Specialty Co.
Standard Steel Works Co.
Westinghouse Traction Brake Co.

Planers. (See Machine Tools)

Pliers, Insulated
Electric Service Supplies Co.

Pneumatic Tools
Ingersoll-Rand Co.

Pole Reinforcing
Hubbard & Co.

Poles, Metal Street
Bates Expanded Steel Truss Co.
Electric Railway Equipment Co.
Hubbard & Co.

Pole Sleeves
Drew Elec. & Mfg. Co.

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Carney & Co., B. J.
Lindsley Bros. Co.
Page & Hill Co.

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Lindsley Bros. Co.
Page & Hill Co.

Poles, Trolley
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
National Tube Co.
Nuttall Co., R. D.

Poles, Tubular Steel
Electric Railway Equipment Co.
National Tube Co.

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Arthur Power-Saving Recorder Co.
Economy Electric Devices Co.
National Ry. Appliance Co.

Pressure Regulators
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Pumps
Schutte & Koerting Co.

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Bonney-Vehslage Tool Co.
International Register Co., The
Wood Co., Chas. J.

Purifiers, Feed Water
Scaife & Sons Co., Wm. B.

Rails
Foster Co., L. B.
Lackawanna Steel Co.

Rails, New
Cambria Steel Co.
Midvale Steel & Ordnance Co.

Rail Grinders (See Grinders)

Rail Joint Plates
Lackawanna Steel Co.

Rail Welding (See Brazing and Welding Processes)

Rails, Relaying
Foster Co., L. B.
Zelnicker, Walter A., Supply Co. Inc.

Rails, Steel
Carnegie Steel Co.

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Rattan
Brill Co., The J. G.
Electric Service Supplies Co.
Hale & Kilburn Corp.
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St. Louis Car Co.

Recorders, Power Saving
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Registers and Fittings
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Rooke Automatic Register Co.

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American Steel & Wire Co.
Carnegie Steel Co.

Repair Shop Appliances (See also Coil Banding and Winding Machines)
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Repair Work (See also Coils)
Cleveland Armature Works
Columbia M. W. & M. I. Co.
General Electric Co.
Independent Lamp Wire Co.
Westinghouse Elec. & Mfg. Co.

Replacers, Car
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

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Columbia M. W. & M. I. Co.

Resistance, Wire and Tube
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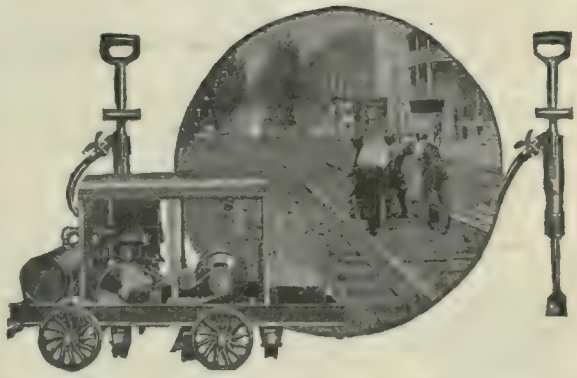
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Brill Co., The J. G.
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Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Holden & White, Inc.
Ohio Brass Co.
St. Louis Car Co.

Sash Fixtures, Car
Brill Co., The J. G.

Sash Metal, Car Window
Hale & Kilburn Corp.

Scrapers, Track (See Cleaners and Scrapers, Track)

Seats, Car (See also Rattan)
Brill Co., The J. G.
Hale & Kilburn Corp.
St. Louis Car Co.

Second-Hand Equipment
Archer & Baldwin
Cleveland Armature Works
Foster Co., L. B.
Griswold Machine Co., G. M.
Hyman Michaels Co.
MacGovern & Co., Inc.
Zeinleker Supply Co., Inc., Walter A.

Shades, Vestibule
Brill Co., The J. G.

Shovels
Hubbard & Co.

Shovels, Power
Brill Co., The J. G.

Signals, Car Starting
Consolidated Car Heating Co.
Electric Service Supplies Co.
National Pneumatic Co., Inc.

Signal System, Block
Electric Service Supplies Co.
Nachod Signal Co., Inc.
U. S. Electric Signal Co.
Wood Co., Chas. N.

Signal Systems, Highway Crossing
Nachod Signal Co., Inc.
U. S. Electric Signal Co.

Slag
Carnegie Steel Co.

Slack Adjusters. (See Brake Adjusters)

Sleet Wheels and Cutters
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Holden & White, Inc.
More-Jones Brass & Metal Co.
Nuttall Co., R. D.

Snow-Plows, Sweepers and Brooms
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Consolidated Car Fender Co.
McGuire-Cummings Mfg. Co.

Soldering and Brazing Apparatus. (See Welding Processes and Apparatus)

Solderless Connectors
Frankel Connector Co.

Spikes
American Steel & Wire Co.

Splicing Compounds
Westinghouse Elec. & Mfg. Co.

Splicing Sleeves. (See Clamps and Connectors)

Springs, Car and Truck
American Steel Foundries
American Steel & Wire Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Standard Steel Works Co.

Sprinklers, Track and Road
Brill Co., The J. G.
McGuire-Cummings Mfg. Co.
St. Louis Car Co.

Steps, Car
American Mason Safety Tread Co.
Irving Iron Works
Universal Safety Tread Co.

Steps, Ladder and Stair (non-slipping)
Irving Iron Works

Steps, Safety
Irving Iron Works

Stokers, Mechanical
Babcock & Wilcox Co.
Green Engrg. Co.
Westinghouse Elec. & Mfg. Co.

Storage Batteries. (See Batteries, Storage)

Strand
Roebling's Sons Co., J. A.

Straps, Car, Sanitary
Holden & White, Inc.

Structural Iron. (See Bridges)

Structural Steel
Lackawanna Steel Co.

Subway Grating
Irving Iron Works

Superheaters
Babcock & Wilcox Co.
Locomotive Superheater Co.
Power Specialty Co.

Sweepers, Snow. (See Snow Plows, Sweepers and Brooms)

Switch Stands
Indianapolis Switch & Frog Co.
Ramapo Iron Works
Wharton Jr. & Co., Wm.

Switches, Track. (See Track Special Work)

Switchboxes
Chicago Fuse Mfg. Co.

Switches and Switchboards
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Synchroscopes
Weston Elec'l Instrument Co.

Tampers, Tie
Ingersoll-Rand Co.

Tanks, Ash and Coal Storage
Green Engineering Co.

Tapes and Cloths. (See Insulating Cloth, Paper and Tape)

Telephones and Parts
Electric Service Supplies Co.

Testing, Commercial and Electrical
Elec'l Testing Laboratories

Testing Instruments. (See Instruments, Electrical Measuring, Testing, etc.)

Thermostats
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
Holden & White, Inc.
Railway Utility Co.
Smith Heater Co., Peter

Thread-Cutting Tools
Williams & Co., J. H.

Ticket Choppers and Destroyers
Electric Service Supplies Co.

Tie Plates
Cambria Steel Co.
Lackawanna Steel Co.
Mulvale Steel & Ordnance Co.

Ties, Mechanical
Dayton Mechanical Tie Co.

Ties and Tie Rods, Steel
Barbour-Stockwell Co.
Carnegie Steel Co.
International Steel Tie Co

Ties, Wood Cross (See Poles, Ties, Posts, etc.)

Tool Holders
Williams & Co., J. H.

Tool Steel
Carnegie Steel Co.

Tools, Linemen's
Bush Electric Co.

Tools, Track and Miscellaneous
American Steel & Wire Co.
Chicago Pneumatic Tool Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Hubbard & Co.
Railway Track-work Co.

Tools, Thread Cutting
Williams & Co., J. H.

Torches, Acetylene. (See Cutting Apparatus)

Towers and Transmission Structures
Archbold-Brady Co.
Bates Expanded Steel Truss Co.
Westinghouse Elec. & Mfg. Co.

Track, Special Work
Barbour-Stockwell Co.
Cleveland Frog & Crossing Co.
Columbia M. W. & M. I. Co.
Indianapolis Switch & Frog Co.
New York Switch & Crossing Co.
Ramapo Iron Works
St. Louis Frog & Switch Co.
Wharton Jr. & Co., Wm.

Track Bolts & Spikes
Lackawanna Steel Co.

Transfer Tables
Archbold Brady Co.

Transfers. (See Tickets)
Archbold-Brady Co.

Transformers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Treads, Safety, Stair, Car Step
American Mason Safety Tread Co.
Universal Safety Tread Co.

Trolley Bases
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Holden & White, Inc.
Nuttall Co., R. D.
Ohio Brass Co.

Trolley Bases, Retrieving
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Holden & White, Inc.
Nuttall Co., R. D.
Ohio Brass Co.

Trolleys and Trolley Systems
Ford Chain Block Co.

Trolley Shoes
Holden & White, Inc.

Trolley Wheels. (See Wheels, Trolley)

Trolley Wire
American Steel & Wire Co.
Anaconda Copper Mining Co.
Roebling's Sons Co., John A.
Rome Wire Co.

Trucks, Car
American Steel Foundries
Bemis Car Truck Co.
Brill Co., The J. G.
McGuire-Cummings Mfg. Co.
St. Louis Car Co.

Tubing, Steel
National Tube Co.

Turbines, Steam
General Electric Co.
Terry Steam Turbine Co.
Westinghouse Elec. & Mfg. Co.

Turnstiles
Perey Mfg. Co., Inc.

Valves
Ohio Brass Co.
Schutte & Koerting Co
Westinghouse Traction Brake Co.

Varnishes. (See Paints, etc.)

Vending Machines, Drinking Cup
Individual Drinking Cup Co., Inc.

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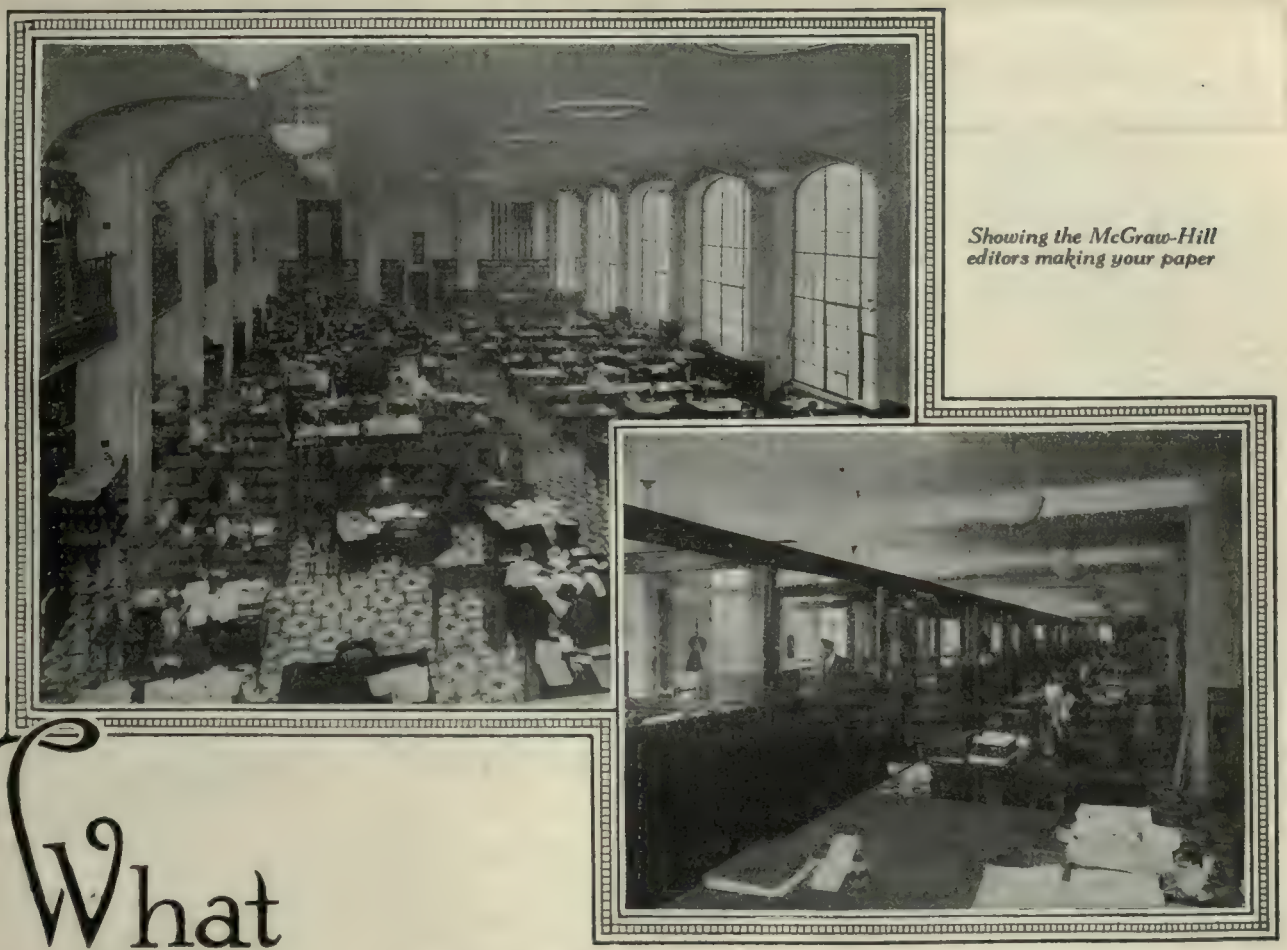
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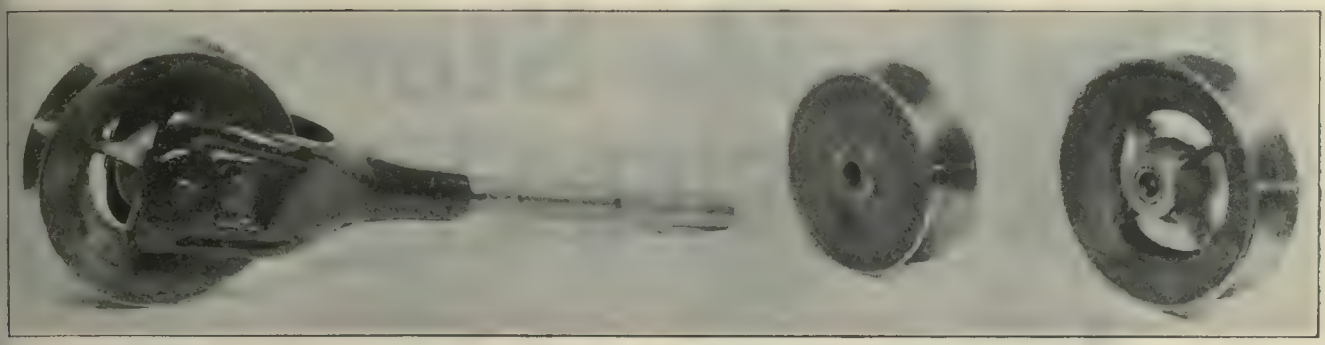
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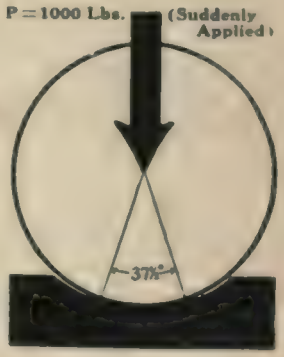
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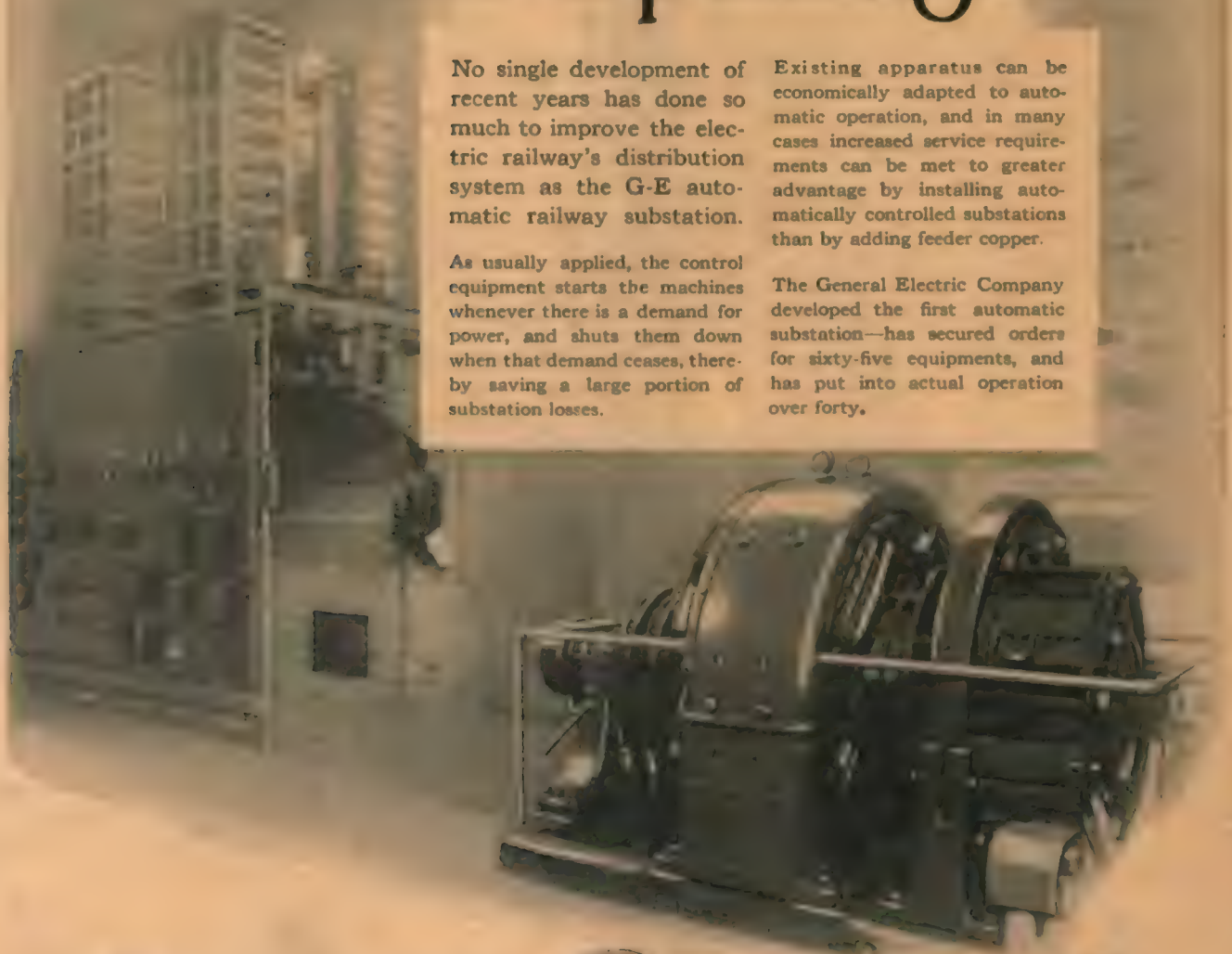
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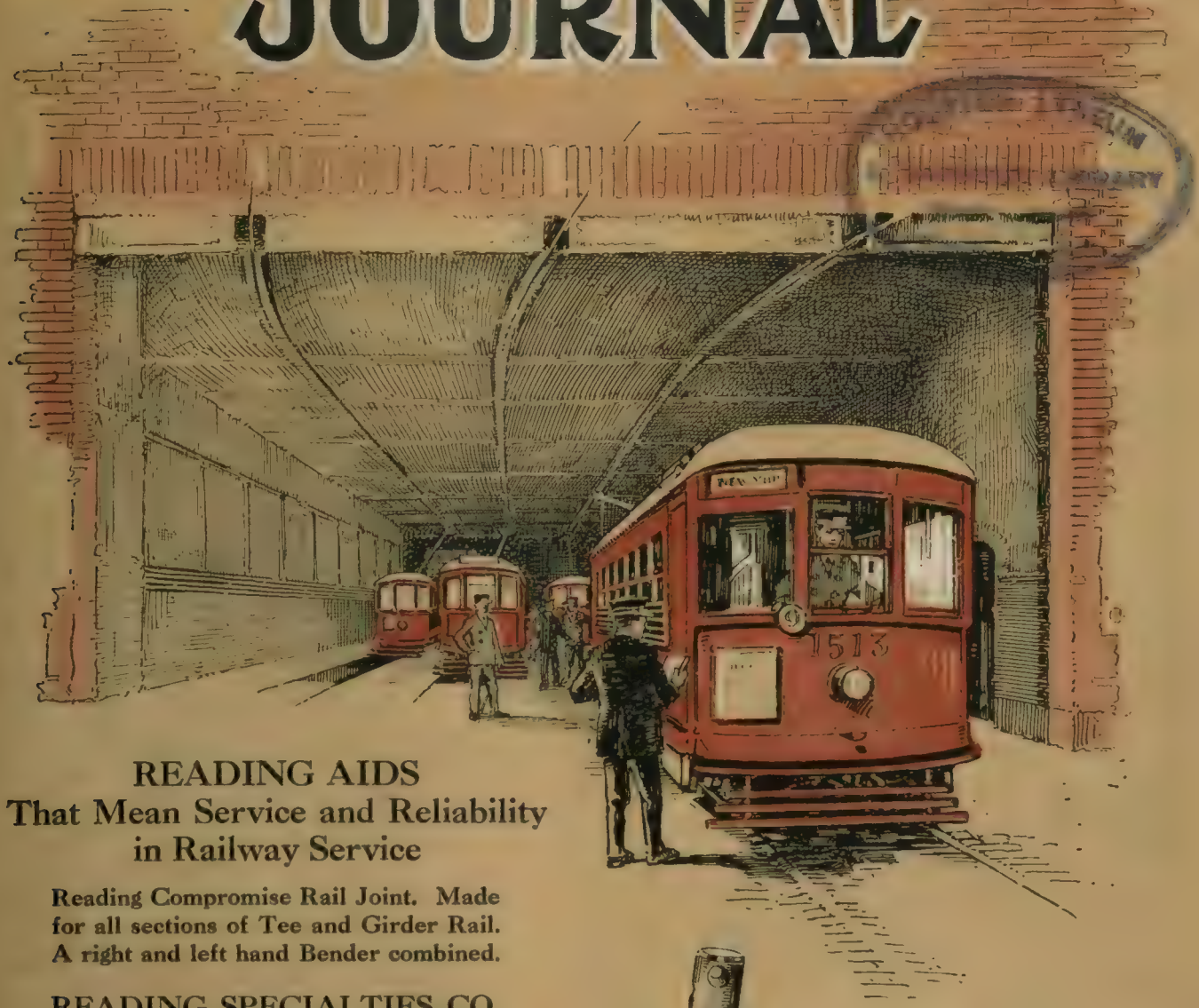
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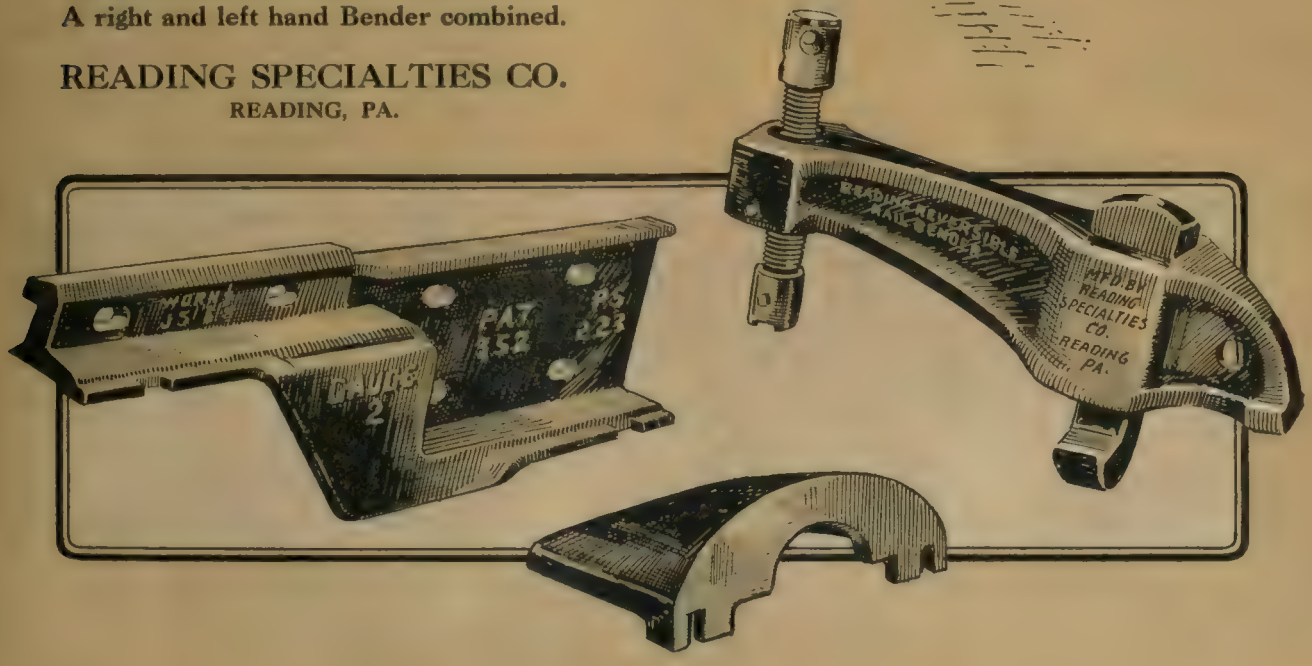
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Vol. 55, No. 12 New York, March 20, 1920 Pages 531 to 630

Electric Railway Journal

H. W. BLAKE, *Editor*

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Economy in Car Painting 561
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Remote Control Sectionalizing Switch 565
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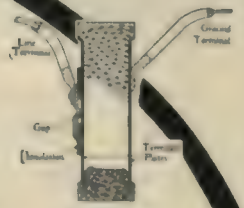
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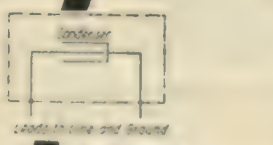
Type MP Arrester, Schematic Diagram showing discharge paths in the arrester, with gap.

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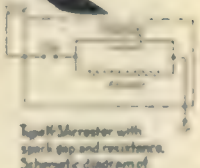
Type K-3 Arrester, without spark gap or resistance,- Schematic Diagram of connections.



Type K-3 Arrester with spark gap and resistance for voltages up to 1500



Type MP Pole or Wall Mounting Arrester for voltages up to 750.



Type K-3 Arrester with spark gap and resistance. Schematic diagram of connections



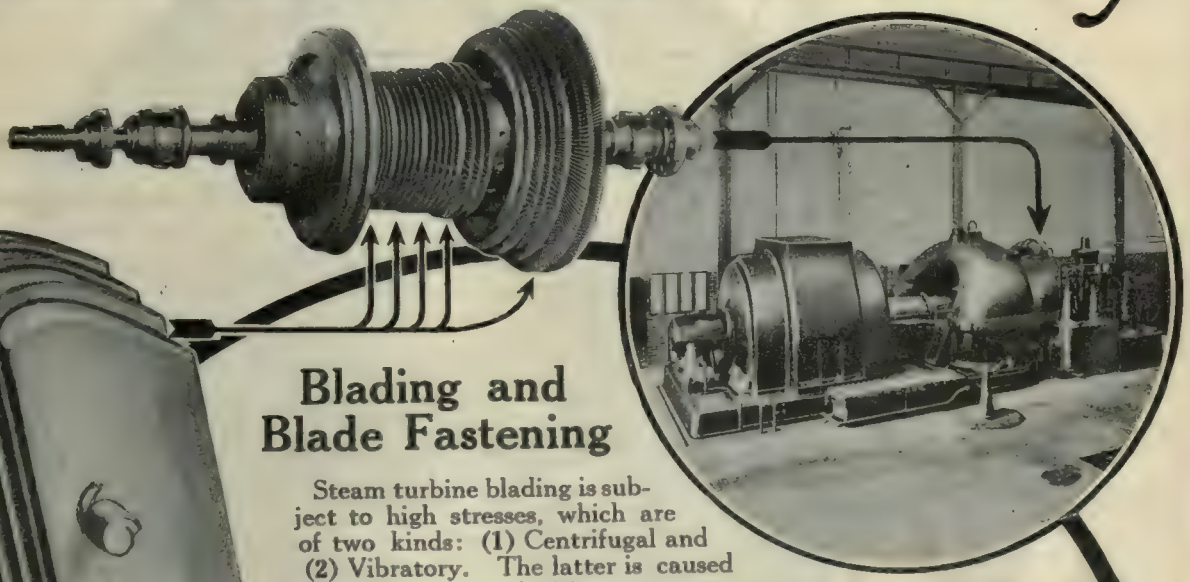
Type A Electrostatic Arrester for voltages up to 2450

W WESTINGHOUSE ELECTRIC

Westinghouse Electric & Manufacturing Company

East Pittsburgh, Pa.

Reliable—and Why



Blading and Blade Fastening

Steam turbine blading is subject to high stresses, which are of two kinds: (1) Centrifugal and (2) Vibratory. The latter is caused by high steam velocities.

Destruction as a result of vibratory stresses is to a great extent eliminated by forming the blade so that its cross-section is greater at the root than at the tip. By tapering the blade section, concentrated stresses at any one point are eliminated.

Destruction as a result of centrifugal stresses is prevented by our method of blade fastening. It is accomplished by means of an interlocking system.

Each blade has a foot forged at the bottom, each foot fitting into a groove cut in the rotor.

All blade feet lie below dovetail packing pieces which fit into the dovetailed groove in the rotor, as shown in the illustration.

This interlocking system of blade attachment eliminates all caulking, and permits ready replacement of blades without injury to rotor or casing.

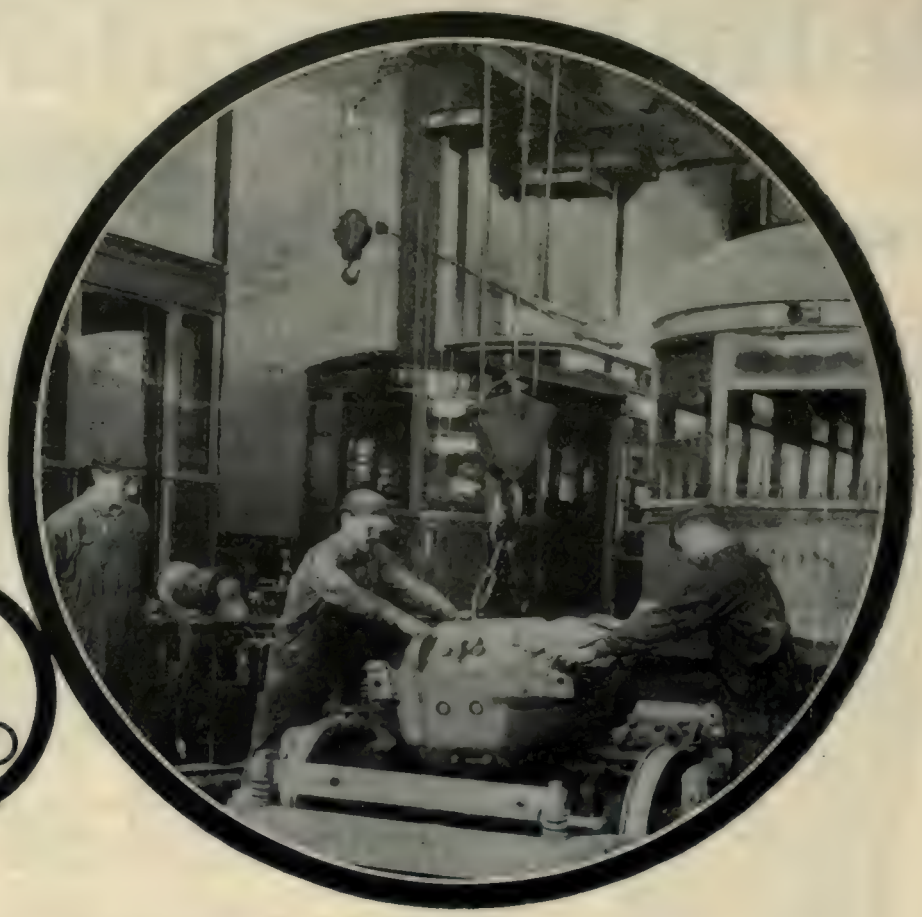
In addition, the blade speeds of a Westinghouse turbine are low, and the blade and rotor stresses are well within the limits of commercial materials of a known, even, high standard of quality.

The rugged rotor and the low blade speeds employed, contribute largely to the extraordinary reliability of the Westinghouse Steam Turbine.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
East Pittsburgh, Pa.

W
WESTINGHOUSE ELECTRIC

Westinghouse



Inspection of Railway Equipment

will often reveal the necessity for the replacement of parts which because of either long usage or improper adjustment have been worn to the limit of their endurance.

Appreciating that such emergencies can be expected with even the finest equipment practically every user of Westinghouse Railway Equipment has insured himself against unpreparedness on such occasions by maintaining at all times a supply of

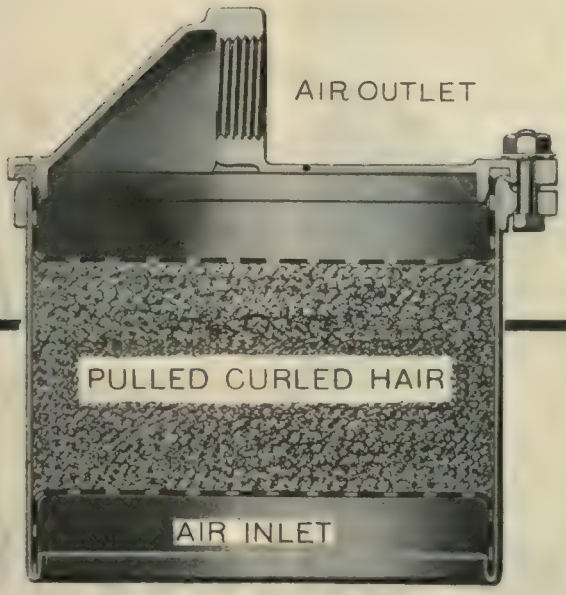
Westinghouse Repair Parts

These parts are identical with those entering into the construction of the original motor—therefore they afford that high degree of cooperation which is favorable to those qualities of efficiency and economy.

Our repair part catalogue makes ordering simple and convenient. If you have not received yours, please advise us immediately.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.

Westinghouse



An Efficient Air Strainer will add years to the Life of an Air Compressor.

Excluding dirt from the Air Compressor makes Perfect Lubrication Possible.

Efficiency and Longevity

are put into the Air Compressor by the new Westinghouse 8-Inch Air Suction Strainer. Its unusually large screening area permits intake air to pass so gently through it that all dirt and grit are deposited in the strainer and only clean air reaches the smoothly machined cylinder walls and delicately fitted piston packing rings of the compressor.

Air Brake Building Our Business For a Lifetime

Westinghouse Traction Brake Company

General Offices and Works: Wilmerding, Pa.

Atlanta, Ga.
Boston, Mass.
Chicago, Ill.
Columbus, O
Denver, Col.
Houston, Tex.
Los Angeles, Cal.
Mexico City
New York, N. Y.
Pittsburgh, Pa.
San Francisco
Seattle, Wash.
St. Louis, Mo.
St. Paul, Minn.



The Ten Points of Efficiency

The Story of

The Safety Car In a City of 66,000

1—Step accidents eliminated.
2—General accidents reduced.
3—Higher schedule speed makes 7 cars do the work of 8 and 8 cars the work of ten.
4—More good words and more patrons for the railway.
5—Jitney bus vamoosing.
6—City Government says "Give us more SAFETY CAR service."
7—Operators pleased with higher wages and easier riding cars.
8—More car miles with less Kw-hours.
9—Less car maintenance.
10—Less track upkeep.

And to conclude—

The operator said:

"It is not a small town car. It is what the name implies—a SAFETY CAR."

Why wait one day longer to order yours?

IT IS A SAFETY CAR ONLY

When equipped with automatic laborless apparatus, so interlocked that, regardless of the illness or distraction of the operator, the power will be cut off instantaneously, the air brakes and sander apply immediately thereafter and the doors unlatch for safe and easy exit. Furthermore, it is a Safety Car only when the doors must be closed and the step folded before the car can start, and when the airbrake must be applied before the doors are opened and the step lowered in bringing the car to a service stop.

SAFETY CAR DEVICES CO.

Main Office—Boatmen's Bank Bldg., ST. LOUIS

CHICAGO
Ry. Exch. Bldg.

NEW YORK
City Invest. Bldg.

PITTSBURGH
Westinghouse Bldg.

CANADA—Canadian Westinghouse Co., Ltd., Hamilton, Ont.



STEEL TWIN TIE TRACK

Where Old Track Must Be Rebuilt—

Some companies leave the old concrete foundation in place, remove the old ties and put down new rail on

Steel Twin Ties

The cross-channels of steel twin ties slip into the old tie spaces; rails are accurately spaced by the tie punching and labor-saving rail clips are quickly applied.

The track is blocked to a new grade and good concrete, well tamped, finishes an economical job to the top of the paving base.

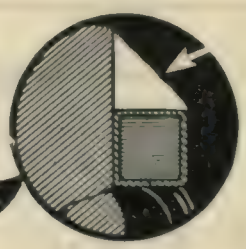
Write for rebuilding plans and details of Steel Twin Tie Economy

THE INTERNATIONAL STEEL TIE CO.
Steel Twin Ties and Crossing Foundations
Cleveland

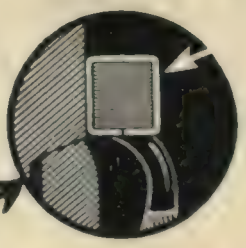
Here Are Specifications For Your Arc Weld Bonds

Investigate arc weld bonding and you'll find certain fundamentals that are essential. The deeper you go, the more necessary these will seem.

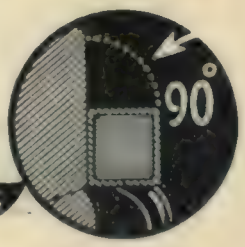
1 Weld must be from "Steel to Steel with Steel." That makes it easy for the operator to get a good job.



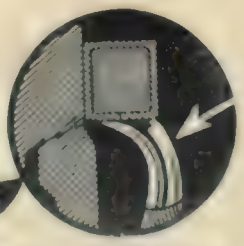
2 Steel must completely surround the copper terminal to protect the copper and reinforce the finished bond.



3 The welding angle must be not less than 90° if a thorough union is to be made between bond and rail.



4 Strand must have protecting sleeve where it enters the terminal.



O-B Arc Weld Bonds meet every clause to the letter. Install O-B Bonds with your present machine or use the O-B Resistance Welder. It has some unusual features for convenient control and for safety.



The Ohio Brass Company, Mansfield, Ohio

New York Philadelphia Pittsburgh Chicago San Francisco Los Angeles



Tuning Up Is Under Way

Winter's gone—we hope.

And it's time to pull the slack out of the trolley, replace fittings or worn wire, perhaps put in an extension or two.

In all this work let O-B Materials help. They will speed the work—improve the line—stand the gaff.

O-B Factory is buzzing at top speed. It's a good idea to make your wants known right away. Check through your stock bins and tell us what you need.

The Ohio Brass Company, Mansfield, Ohio

New York Philadelphia Pittsburgh Chicago San Francisco Los Angeles

O·B LINE MATERIAL

Frogs, Crossovers, Section Insulators and Strain Plates, all with cam tips.

Ears and Clamps.

Splicers.

Porcelain X Strain Insulators.

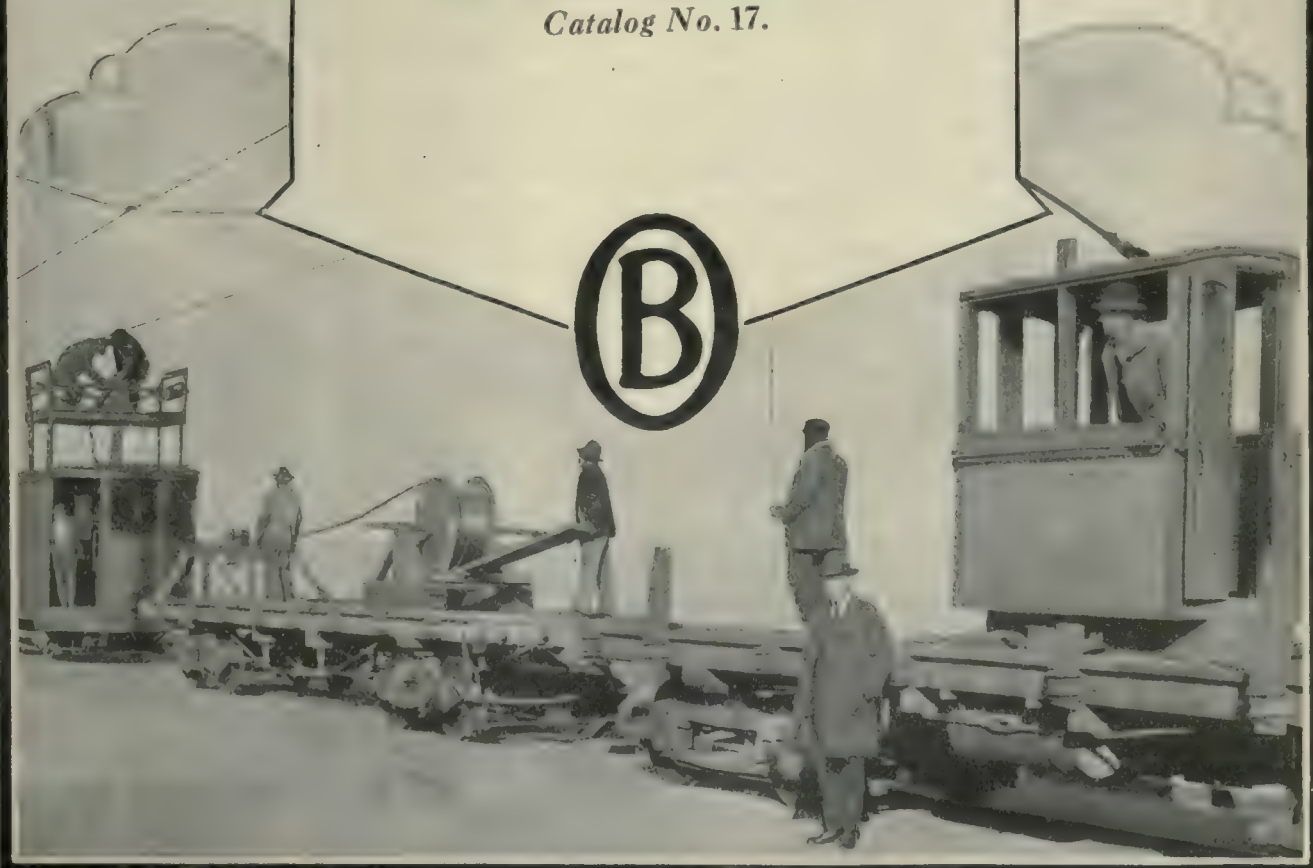
Wood Strain Insulators.

Porcelain Insulators.

Insulated Hangers—especially the lock type.

National Trolley Guard.

Leaf through pages 283-426 *of Catalog No.* 17.





At Glasgow

The World's Busiest Street Railway

The Glasgow Corporation Tramways are carrying now an average of some twenty passengers per car mile, a record unapproached.

Of course, the tramways have looked into the matter of longest-lived trolley wire—

and understand the value of Phono-Electric Trolley Wire for hard jobs, as is shown by the selection of Phono-Electric 00 for use on such proving grounds as Renfield Street, between St. Vincent and Cowcaddens, where cars are run at intervals of less than one-half minute—

and on the sharply curved turn between London and Great Hamilton Streets via Ross Street—a busy spot, like almost every tramway spot in Glasgow. Try Phono-Electric on your "hardest spots" first and learn that it outlasts copper three to one.

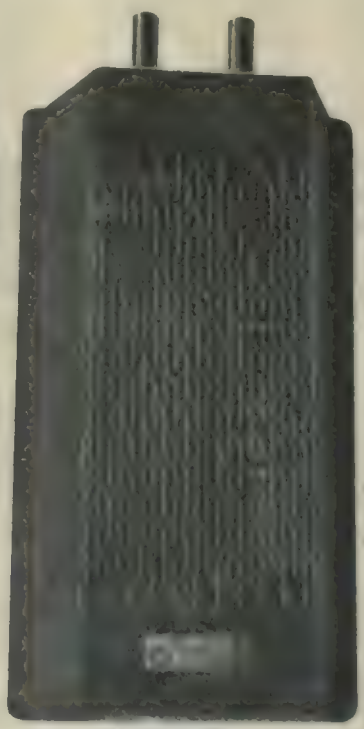

Trolley Wire
SPRINGBURN
Bridgeport Brass Company
Bridgeport Connecticut

Holden & White
Electric Car Heaters

The Simplest, Lightest, Safest and Most Durable Heaters ever produced for electric railway cars



Truss Plank Type, interior view showing Cutler-Hammer heating units



Vestibule Type

Full line of heaters for Cross Seat, Panel, Truss Plank and Vestibule service. Ranging in wattages from 300-watt single unit to 2,000-watt four-unit heaters. Voltages to operate with units in series of 2, 3, 4, 5, 6 and 8. Heaters consist of 1, 2 and 4 units.

Using CUTLER-HAMMER UNITS

Send for Catalogue giving full description

Holden & White Inc.

817 Fisher Building, Chicago

Eastern Representative, National Railway Appliance Co., New York, Washington



STRENGTH

For All Loads

Northern White Cedar Poles

Just as the lighthouse must stand for years under the smashing of waves, wind and weather to serve men and their needs, so stand Northern White Cedar Poles under all conditions of weather for twenty years or more.

Keen buyers of poles in all parts of the United States and Canada specify Northern White Cedar Poles—the poles of great strength and long life.

Poles shown here are at East Chicago, Indiana, in the lines of The Northern Indiana Gas and Electric Co.

They are 8-inch 45-foot poles, and were set in 1912. Recent inspection shows they are good for many years of service. The loads carried are, from left to right:

No. 1. 1—⅜ Messenger
3—No. 2 B & S Solid
6—No. 2 B & S Stranded

No. 2. 6—No. 2 B & S Stranded
14—No. 6 B & S W.P. Solid
11—No. 00 W.P.

No. 3. 3—No. 00 Stranded Bar
3—No. 2 Stranded Bar

For further pole information, write the

Northern White Cedar Association
Lumber Exchange, Minneapolis, Minn.

NORTH AND SOUTH A





Lexington, Ky.

for their

Down in Kentucky, where everything above the Mason & Dixon line is considered north, they are using "Elreco" Combination Poles for their "White Way." Up near the Canadian Border the city of Niagara Falls has made White Ways of its streets by using "Elreco" Combination Railway and Lighting Poles.

By interesting the city fathers you can *also* have a "White Way" in your city and feel secure, too, that your trolley wire is carried in the safest, neatest, most modern fashion.

You get a permanent, tubular steel pole to carry your trolley span wires, you create better relations with the people because of your cooperation in promoting the interests of the city; and your revenue is increased because of the growth of

ELECTRIC RAILWAY

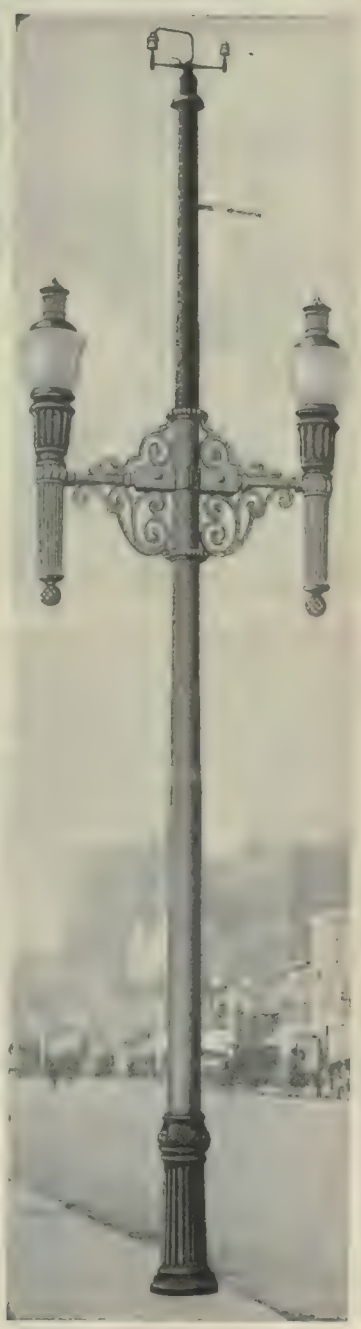
Cincinnati,

30 Church St.,

GREE ON "ELRECO" POLES



Niagara Falls, N. Y.



"White Ways"

business that will surely follow on this White Way. The city gets neat appearing tubular steel poles that do not infringe on the sidewalks to any extent; ornamental, artistic brackets, fittings, and handsome lighting units for the "White Way" alleviation of the troubles caused by sagging and complicated wiring, as well as decrepit wooden pole lines.

Can your city afford to be without a "White Way"?

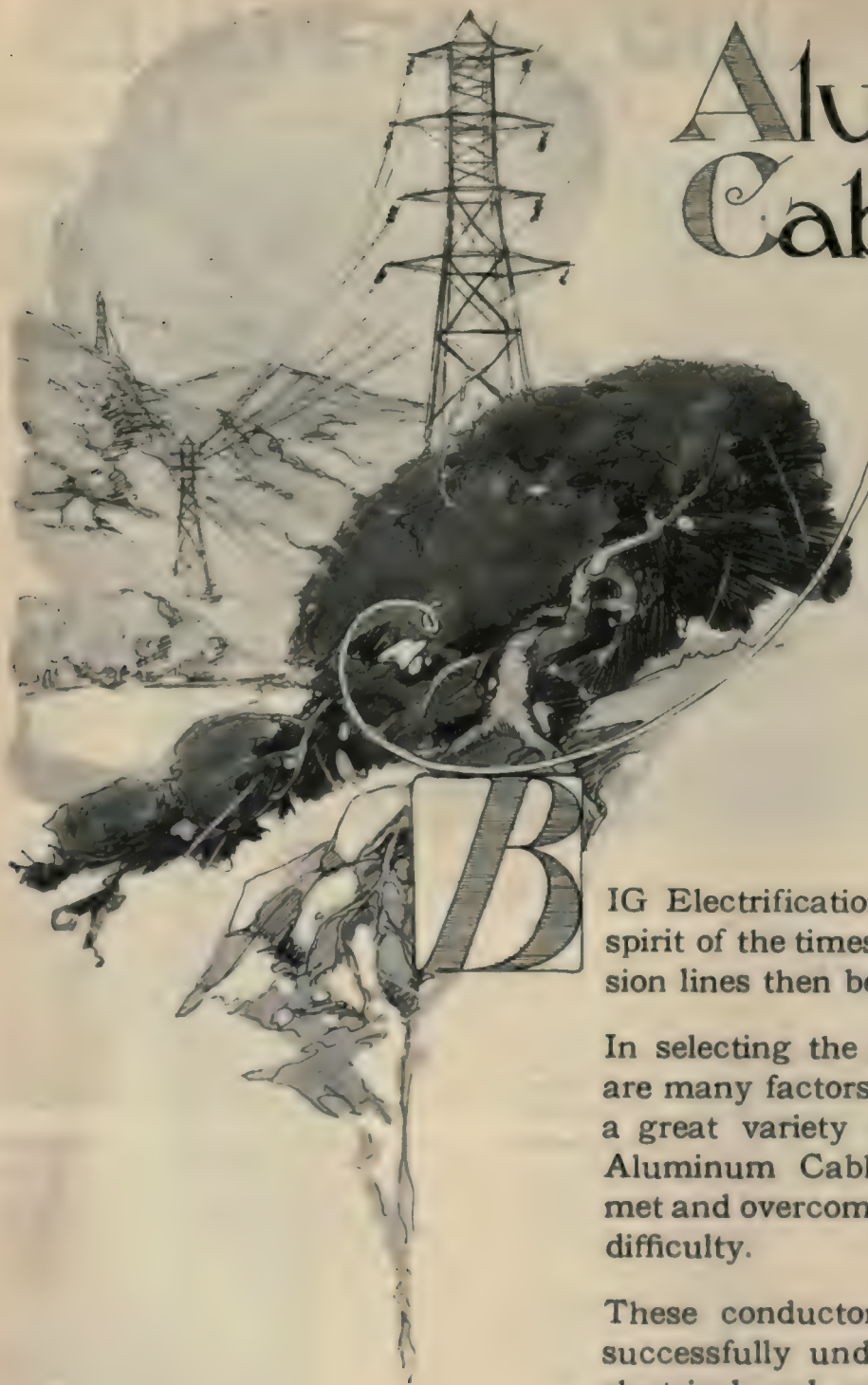
Missoula, Pittsburgh, Lexington, Niagara Falls, Lynchburg and scores of others have decided they needed a "White Way" and *your* city needs one, too.

Send for Catalog "F"

EQUIPMENT COMPANY

Ohio

New York City



Aluminum Cable Steel Reinforced

BIG Electrification developments are the spirit of the times. High voltage transmission lines then become a leading problem.

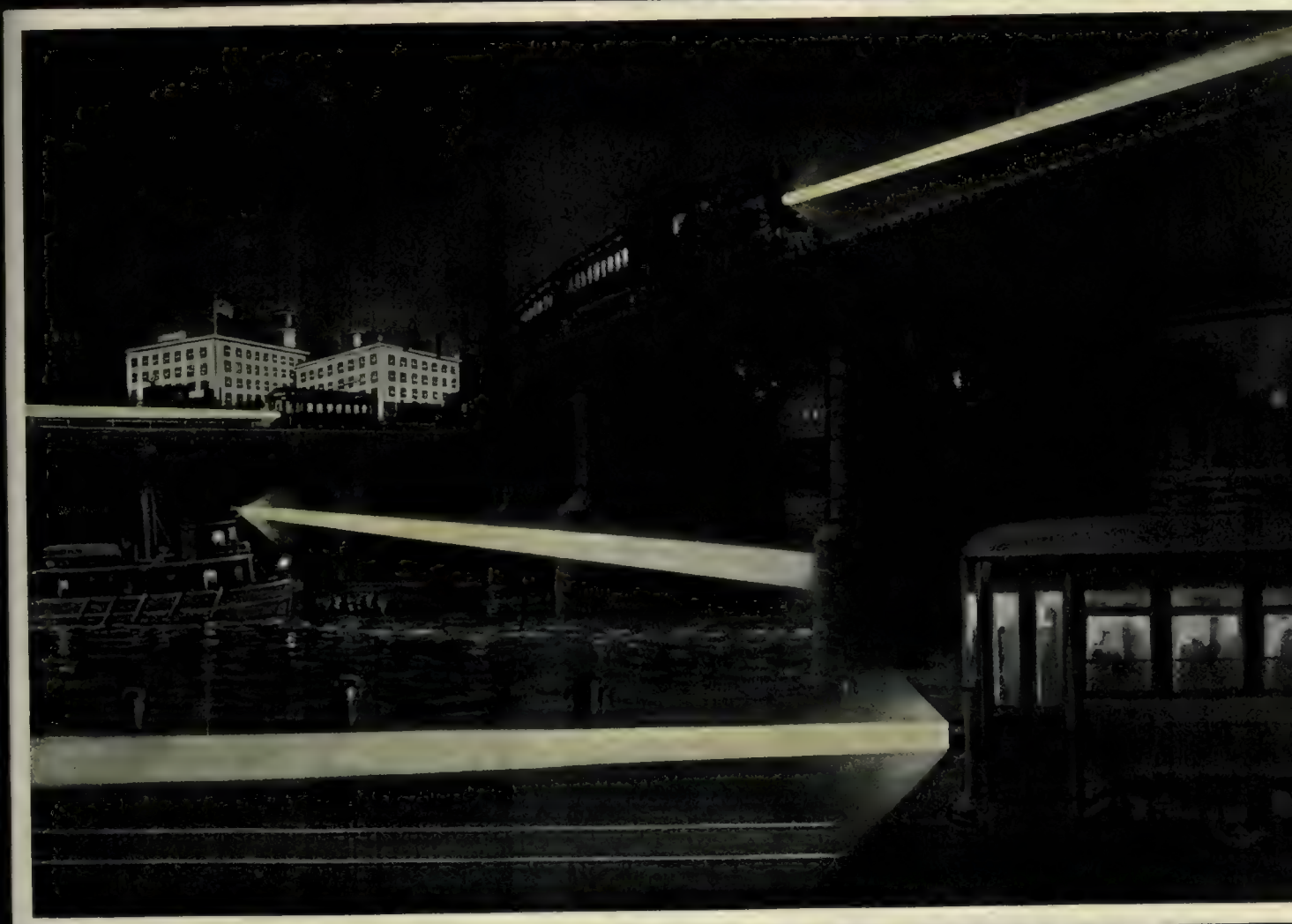
In selecting the proper conductors there are many factors to be considered. With a great variety of experience behind it. Aluminum Cable Steel Reinforced has met and overcome practically every known difficulty.

These conductors are today operating successfully under all kinds of climatic, electrical and mechanical conditions.

Your particular problem is of great interest to us. Our sales engineers want to help you solve it.

Aluminum Company of America · General Offices · Oliver Bldg · Pittsburg · Pa · U.S.A

"GOLDEN GLOW" PRODUCTS



You can buy "Golden Glow" headlights, searchlights or projectors especially designed for electric railway c
For steam, industrial and mine locomotives. For steamboats, tugboats and motor boats. For floodlight
and for many other special uses.

In all types you will find the famous "Golden Glow" greenish-glass reflectors. Reflectors which are truly "famous," because they project a golden light which is not nearly so blinding and which is more penetrating than brilliant white light, because they are so exactly parabolic in form, because they will wear indefinitely without corroding or tarnishing, because they are so easily cleaned, because of the special patented process by which they are ground and polished. They are, in fact, the only accurately ground and polished parabolic mirror on the market which can be manufactured and sold at a commercial price.

On the following page you will find several types of "Golden Glow" headlights; each is typical of many other similar types.

Write for data sheets



"GOLDEN GLOW"
Steam Locomotive Headlights

"GOLDEN GLOW"
Electric Railway Headlights

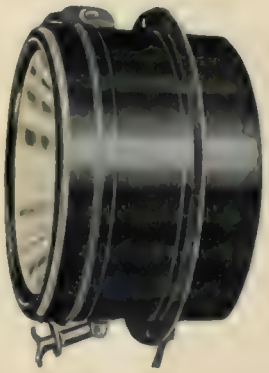
"GOLDEN GLOW"
and "CRYSTAL MIRRO
Floodlighting Projector

"GOLDEN GLOW"
Marine Searchlights

"GOLDEN GLOW" PRODUCTS



Typical "Golden Glow" Marine Searchlight



Typical "Golden Glow" Electric Railway Headlight for city and suburban service



Typical "Golden Glow" Mine Locomotive Headlight



"Golden Glow" or "Crystal Mirror" Portable Floodlighting Projector



Typical "Golden Glow" Electric Railway Headlight for interurban service



Typical "Golden Glow" or "Crystal Mirror" Floodlighting Projector



Typical "Golden Glow" Steam Locomotive Headlight

ELECTRIC SERVICE SUPPLIES CO.

MANUFACTURERS

PHILADELPHIA
17th and Cambria Streets

NEW YORK
50 Church Street

CHICAGO
Monadnock Building

OKONITE

TRADE MARK REG. U. S. PAT. OFFICE

TAPES and WIRES

"MANSON" TAPE (Friction)

"OKONITE" TAPE (Splicing Compound)

These Tapes Have Become Standard

"OKONITE" Insulated and Varnished Cambric Wires and Cables

Made with especial regard for *Quality*

We are prepared to handle any high grade proposition, and solicit your inquiries.

THE OKONITE COMPANY, Passaic, N. J.

Incorporated 1884

CENTRAL ELECTRIC CO., Chicago, Ill., General Western Agents

F. D. Lawrence Electric Co.
Cincinnati, O.

Novelty Electric Co.
Philadelphia, Pa.

Pettingell-Andrews Co.
Boston, Mass.



Traffic Interrupted by Double-Tracking

Increase Your Car

UNITED STATES

They cost less than Double-Tracking

The biggest field today for the light-weight safety car is in the small or medium-sized city—the very place where a large portion of the lines are single-track.

You know that hand-thrown or other inferior signals will not do on such lines if you shorten the present headways.

But you also know that at the present cost of labor and track material, the cost of double-tracking would be absolutely out of the question.

United States Electric Signals offer the economical way out from unprofitable, long headways with unreliable signals to profitable, short headways with reliable signals.

A generation of success in signal specialization stands back of United States equipment.

United States Electric Signal Company
West Newton, Massachusetts

Representatives:
Western: Frank E. Bodler, Monadnock Bldg., San Francisco
Foreign: Forest City Electric Services Supply Co., Salford, England



No Interruption of Traffic

Service with the Aid of TROLLEY CONTACT SIGNALS

They can be installed on short notice

Aside from the prohibitive expense of double-tracking to permit more service with greater safety, is the fact that suitable rails cannot be obtained for months.

United States Electric Signals, on the contrary, are obtainable on short notice, thereby permitting better, more profitable service to be given quickly in addition to the enormous saving in first cost compared with double-tracking and the inevitable accompaniment of street opening, re-paving, re-construction and delays to regular traffic.

If you are looking for an immediate, a safe and a low cost solution of the short-headway problem on your single-track city and suburban lines, you cannot do better than ask us to signal your trackage.

A generation of success in signal specialization stands back of United States equipment.

United States Electric Signal Company

West Newton, Massachusetts

Representatives:

Western: Frank F. Bodler, Monadnock Bldg., San Francisco

Foreign: Forest City Electric Services Supply Co., Salford, England



The "B" assortment $50.00

Tell your foreign-born employees about

"Food Drafts"

HERBERT HOOVER, in a letter published in our editorial pages, urges engineers to explain the Food Draft System to their foreign-born employees and to interest them in its possibilities and value.

The American Relief Administration has on the press a quarter-sheet poster telling all about this, in all the essential foreign languages.

The 11 McGraw-Hill Publications strongly urge the cooperation of their readers in this most economical and practical method of supplying needed food to sufferers in Europe, and recommend sending for as many of these posters as you can use. Address American Relief Administration, 115 Broadway, New York. *They will be sent free of all charge.*

Power
Coal Age
American Machinist
Ingenieria Internacional
Electric Railway Journal
Engineering News-Record
Engineering & Mining Journal
Chemical & Metallurgical Engineering

And the Electrical Trio
Electrical World
Journal of Electricity
Electrical Merchandising

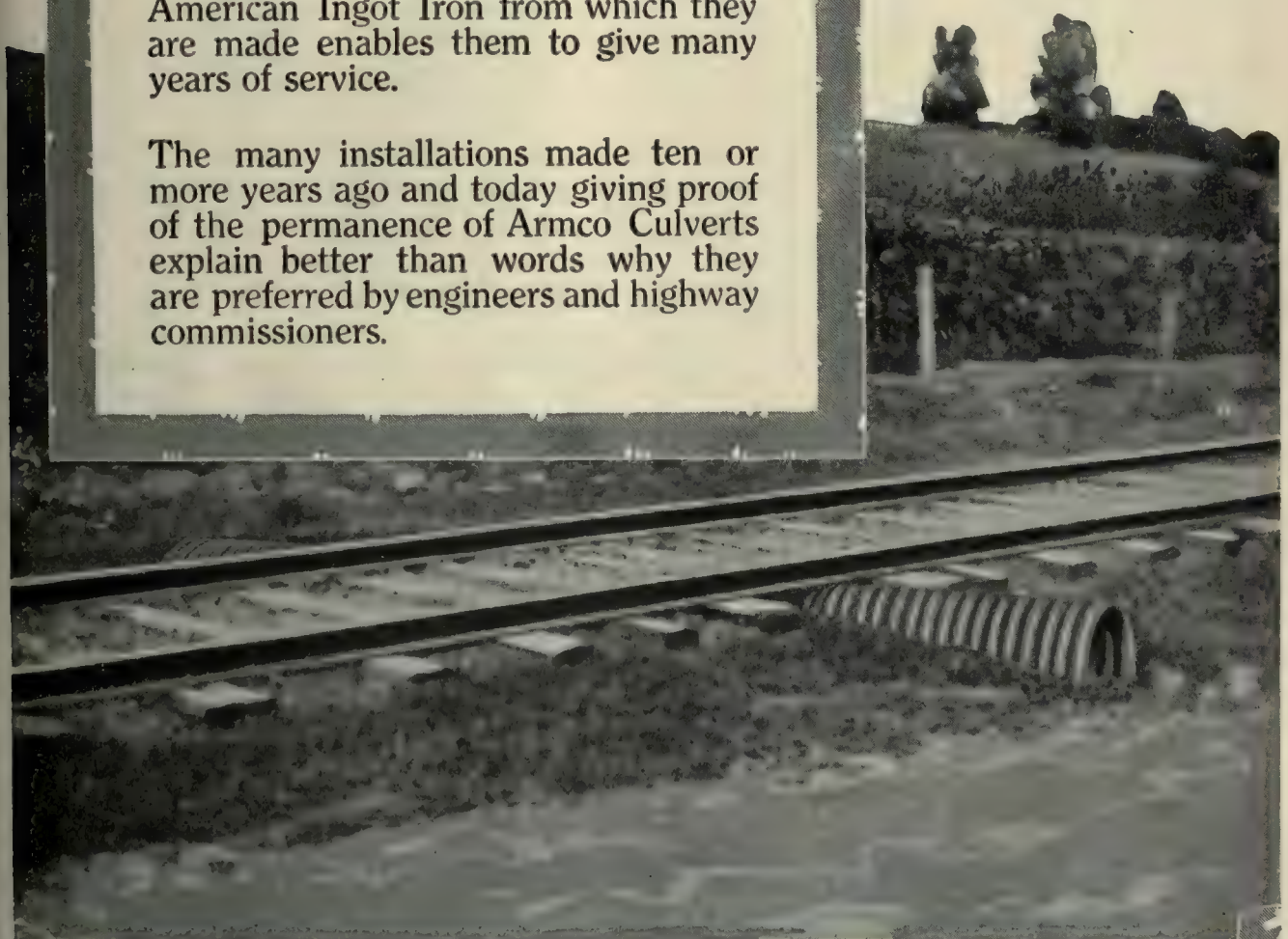
The 11 McGraw-Hill Publications
Tenth Avenue at 36th Street
New York, N. Y.

In Perfect Condition After Nine Years of Severe Service

With heavy trains rolling over it day after day and only a light fill to protect it, this Armco Culvert is in perfect condition after nine years of service.

Very often, Armco Culverts are subject to extremely severe conditions, yet their rugged construction and the purity of American Ingot Iron from which they are made enables them to give many years of service.

The many installations made ten or more years ago and today giving proof of the permanence of Armco Culverts explain better than words why they are preferred by engineers and highway commissioners.



ARMCO

LOOK FOR THE TRIANGLE TRADE MARK

AMERICAN INGOT IRON

There is a manufacturer in nearly every state, and in Canada, making genuine rust-resisting ARMCO CULVERTS and other products of American Ingot Iron such as flumes, siphons, tanks, road signs, roofing, etc. Write for full information and nearest shipping point on products in which you are interested.

ARMCO IRON CULVERT & FLUME MFRS. ASSN.

TRANSPORTATION BLDG. CHICAGO

"Almost Daily

"We have used your Electric Drill almost daily for six years and do not know of any other method which would give as good results either in economy or efficiency"—Savannah Electric Company

Over 1200 Little Giant Electric Track Drills in use on hundreds of traction lines in the United States are today drilling bolt holes at rail joints at a rate *ten to twelve times faster* than old-time hand methods, and at a saving of 85 to 90% in costs!

Put Little Giants on your spring track construction and repair program. They will accomplish the drilling tasks faster, better and cheaper, and release valuable track hands for other urgent duties.

Ask for bulletin.



The Little Giant "family" of electric track tools also includes Portable Drills for drilling tie holes for screw spikes, Portable Spike Drivers for setting them and Portable Grinders for grinding rail joints, and for welded bonds. Also a complete line of portable electric tools highly useful for countless shop operations.

Ask for a complete set of bulletins



Chicago Pneumatic Tool Company

1062 Fisher Building, Chicago

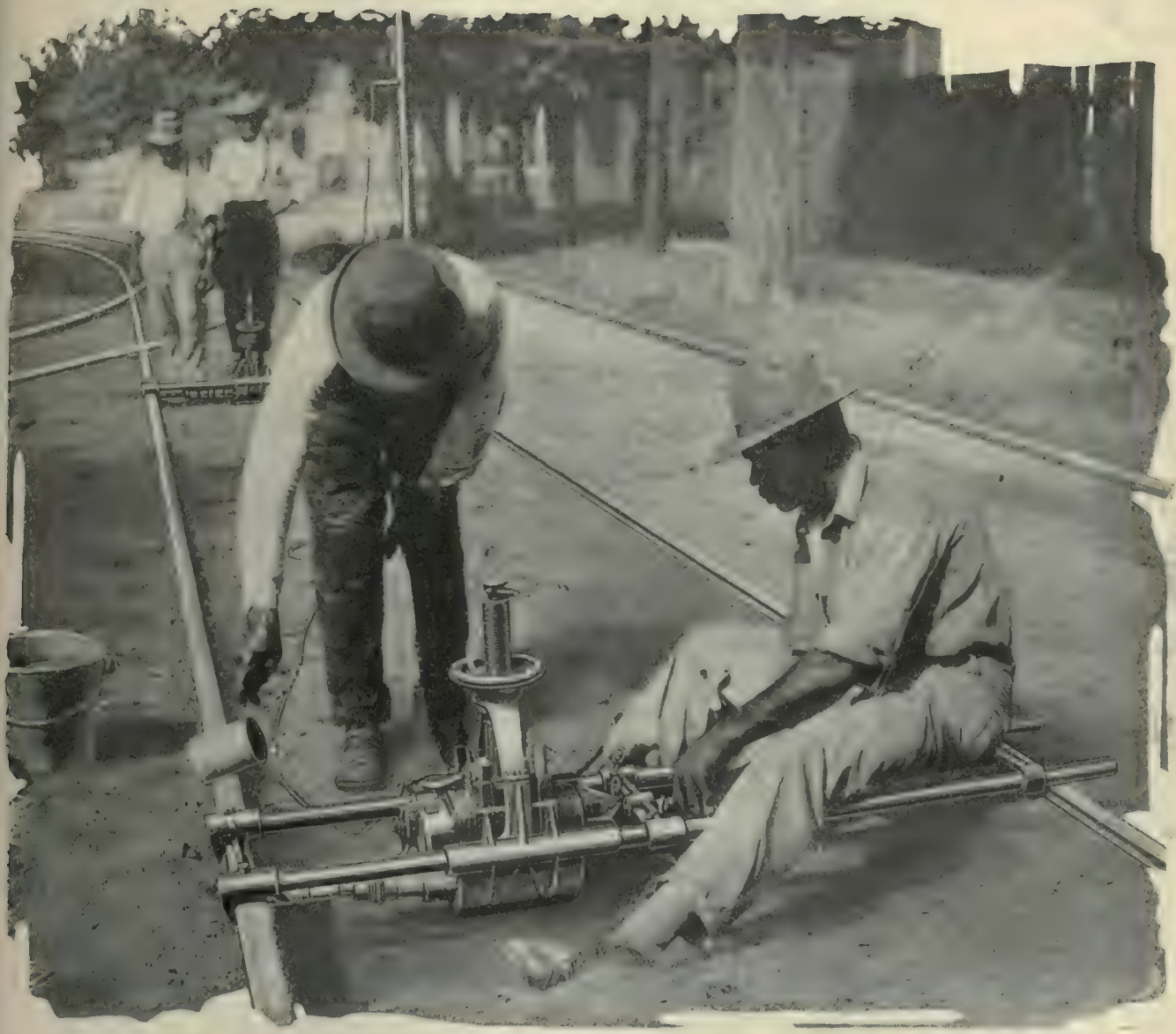
Sales and Service Branches all over the World

BOYER PNEUMATIC HAMMERS · · LITTL
CHICAGO PNEUMATIC AIR COMPRESSOR
· GAS AND STEAM ENGINES

LITTLE

Portable Electric

for Six Years"—



EL-17

GIANT PNEUMATIC AND ELECTRIC TOOLS
VACUUM PUMPS · · GIANT FUEL-OIL,
ROCK AND COAL DRILLS

CHICAGO PNEUMATIC

GIANT

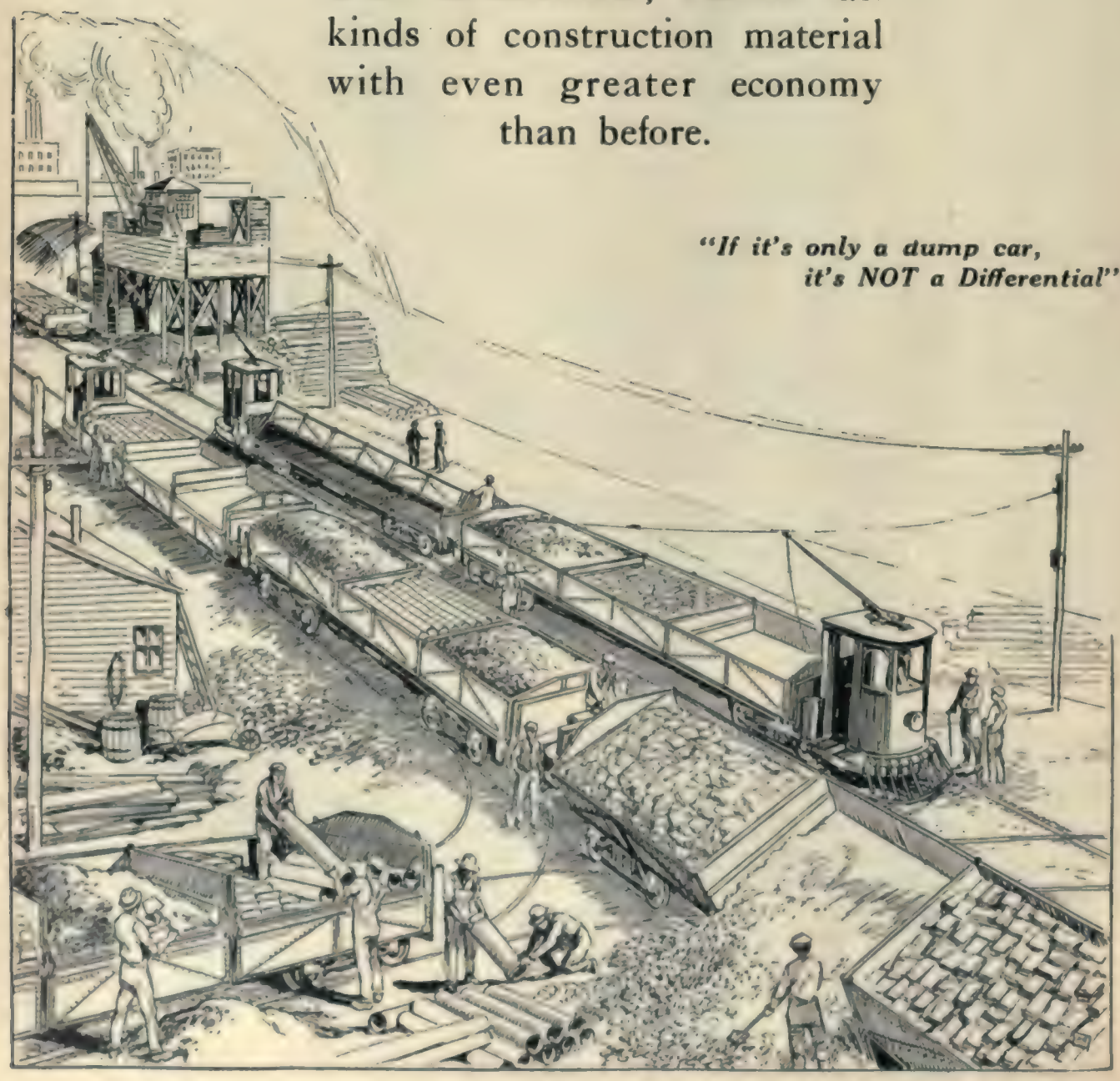
Track Tools

DIFFERENTIAL

Utility in Construction

Differential Cars, with new drop door mechanism, handle all kinds of construction material with even greater economy than before.

"If it's only a dump car, it's NOT a Differential"



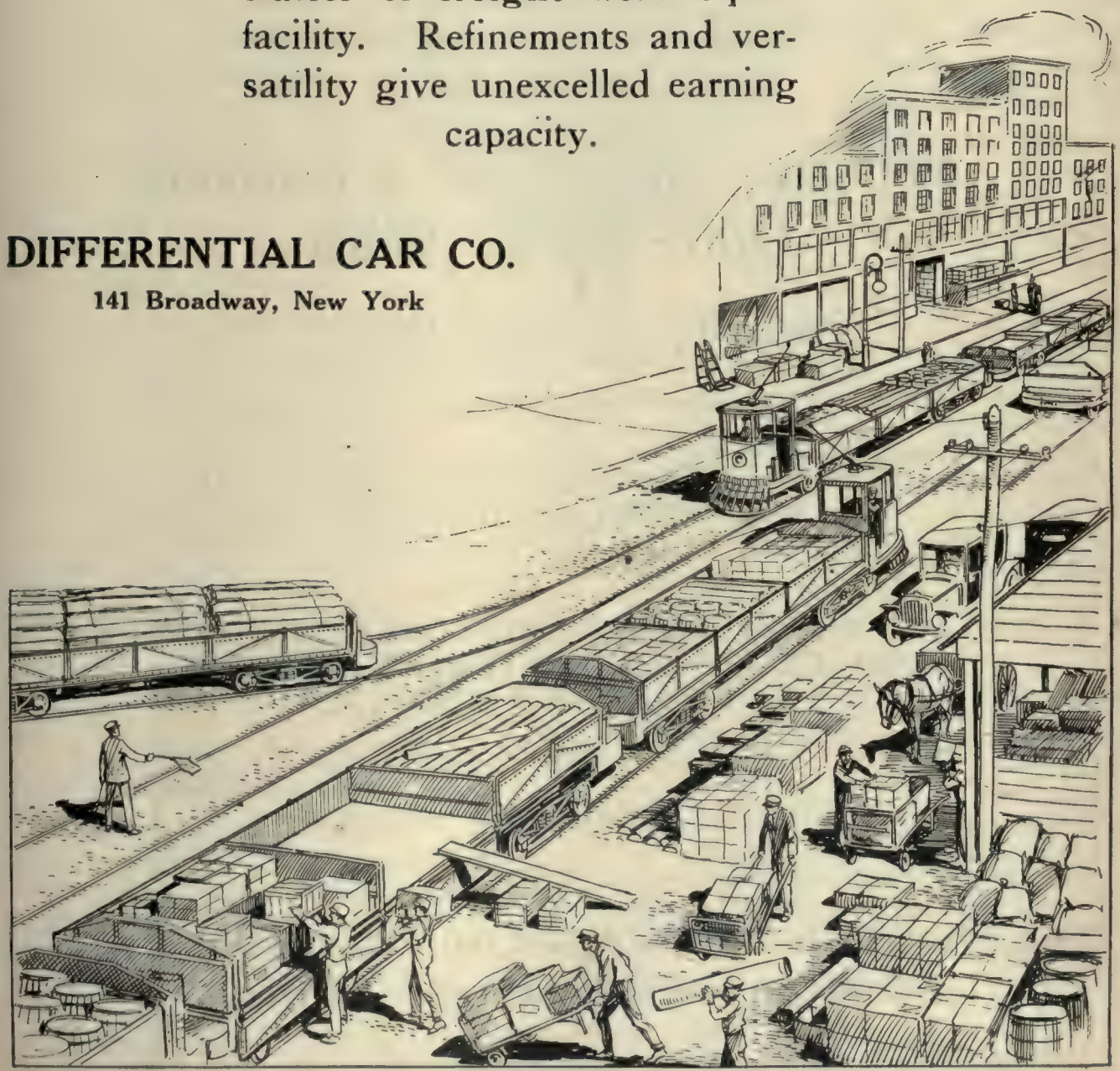
UTILITY CARS

Utility in Handling Freight

Differential Cars handle all classes of freight with equal facility. Refinements and versatility give unexcelled earning capacity.

DIFFERENTIAL CAR CO.

141 Broadway, New York



Important Notice

We are now able to supply our

Arthur Power-Saving Recorders

With an Added Feature
whereby the need for

Winding the Clock is Entirely Done Away With

Likewise the keyhole in the outer case is eliminated thereby making the recorder entirely dust-proof and tamperproof

The self-winding feature is so simple that it will add very little to the former price.

THE ABOVE IS MERELY ANOTHER ONE OF THE SUPERIOR AND EXCLUSIVELY PATENTED FEATURES OF THE ARTHUR RECORDER

Prices and Particulars upon Application

The Arthur Power-Saving Recorder Co.

Second National Bank Building, New Haven, Conn.

Thousands of

Arthur Power-Saving Recorders

are in successful use

WHY?

Because they save power, increase safety and decrease wear and tear on car equipment



Because they record *in minutes* how long the motorman runs his car with power on

"It talks the language of the motorman"

Other Reasons Why They Are Preferred:

1. Are easiest for the motorman to understand.
2. Following up the records costs the least.
3. Are most reliable — have no delicate parts to jar out of order.
4. Are fairest to the motorman under all conditions.
5. Are equally accurate at all line voltages.
6. One standard instrument fits all types of cars.
7. They provide valuable data for use of Inspection and Engineering Departments.
8. **Absolutely no expense for winding up of clock mechanism—are fitted with self-winding attachment.**
9. Are most economical to purchase, install and maintain.
10. Are dust-proof and tamper-proof.
11. For the above reasons are most effective in results.

Once get the motorman to "start thinking" about how much he can run his car with power shut off and he soon learns to take advantage of every factor that will help his record — for instance:

1. By coasting wherever possible.
2. By not crowding too close to the car ahead.
3. By not fanning the brakes.
4. By not carelessly allowing the brakes to drag.
5. By not applying power and brakes at the same time on down grades.
6. By not running ahead of time, or leaving terminal or end of line late.
7. By not keeping power on so long as to produce unnecessarily high and possibly dangerous speeds.

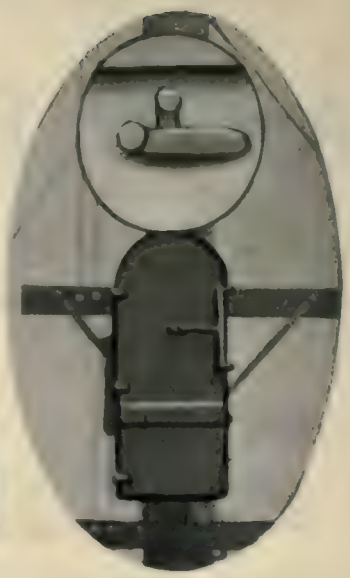
It is obvious that by running with power shut off as much as possible, the car is held under better control and can be more quickly stopped in an emergency. *Many accidents are thereby avoided.*

For further information write to

THE ARTHUR POWER-SAVING RECORDER CO.

Second National Bank Building, New Haven, Conn.





For Safety Sake

In this day of Safety Car operation,

Chapman Automatic Signals

are essential, in order to

Safeguard the passengers.
Maintain the schedules.
Relieve the operator from the necessity of leaving his car to operate hand thrown signals.

The safety factor means decreased claims, decreased repairs to equipment, and less worry to the Manager.

The maintenance of the schedule means increased satisfaction to the customers, and increased revenue because of increased riding.

Relief to the operator is imperative. Add not to his duties by making it necessary for him to leave his car to operate the signals.

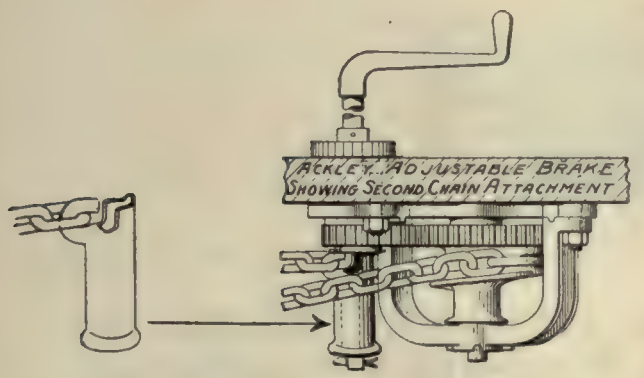
CHAPMAN AUTOMATIC SIGNALS accomplish all.

You will certainly be satisfied with them. Write now.

Charles N. Wood Co., Boston, Mass.

Ask thousands of operating officials in over 45 countries

ACKLEY



The Ackley Adjustable Brake

The Ackley Companies own all patent and sales rights over the whole world except U. S., Canada, Mexico and Hawaii.

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RUST & ACID FUME PROOF

The Ideal Maintenance Paint

G & B starts where the usual paint leaves off.

Acid-fume, rust and damp proof. *This means just what it says.*

There is no material entering into power plant or railway construction and maintenance which will not have its efficiency and life increased by its application.

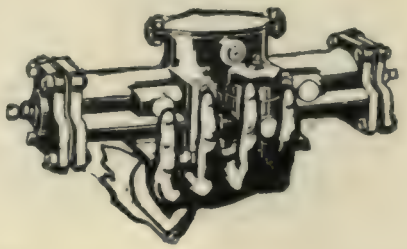
Ackley Brake & Supply Corporation

50 Church St., New York, U. S. A.

Cable Address: Acklebrake

What does the Safety

Pneumatize!



When the first safety cars were ordered, the dominant idea was to achieve the end expressed by the name—SAFETY.

And this end was achieved largely through the automatic inter-operation of control, of brakes and of *door and step.*

Which automatic operation was made possible largely by the application of the National Pneumatic Door Engine—the standard door engine of the standard Safety Car.

Get Safety and Efficiency

National Pneumatic Company, Inc.

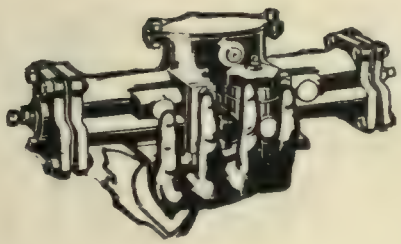
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Works: Rahway, N. J.

Pneumatize!

Movement mean to you?

Pneumatize!



To-day the number of companies which are using or have ordered safety cars is rapidly nearing 200.

And the time is not far off when *every* city railway in the United States and Canada will have SAFETY FEATURES on *all* cars whether for one-man or two-man operation.

And just here is the place where National Pneumatic Car Speed-Up and Economy Devices dovetail with the great Safety Car development, because.....

The Safety Car has demonstrated the practicality of the air-operated door and step for every type of rolling stock from smallest unit to largest train.

The National Pneumatic Door Engine, National Pneumatic Door and Step Operating Mechanisms and National Pneumatic Motorman's Signal Lights or Safety Interlocking Door Control are all at your command to

every hour of the day!

National Pneumatic Company, Inc.

50 Church St., New York Edison Bldg., Chicago

Works: Rahway, N. J.

Pneumatize!

— Spring work opens

"Yes, I noticed Bill Small out with his team the other morning. He nearly had a runaway. Bill says his horses try to hurdle the trolley track every time he drives across. One horse was knocked down. Bill put in a kick and the Trolley Co. sent a push affair out one morning with a couple of fellows and they welded a copper cable across between the rails right near the crossing. I notice they are doing that at several of the crossings. One of the fellows said that it would prevent shock to a horse. I notice they are looking over the track as they go along, doing a little work here and there. That push affair seems to be a handy sort of rig. It works fast and when a car comes in sight the fellows pick it up and set it to one side."



The best, most rapid and economical method for rail bonding on the market today.

Write for information and prices.

THE ELECTRIC RAILWAY IMPROVEMENT CO.

Cleveland, Ohio



ACKLEY BRAKES

sell on merit—

They ought to, for their design rests upon sound experience and their development has run hand in hand with that of the Electric Railway.



Bulletin D

Specify for New Cars—Buy for Old Cars



Bulletin E

ACKLEY NO-STAFF BRAKE TRADE MARK

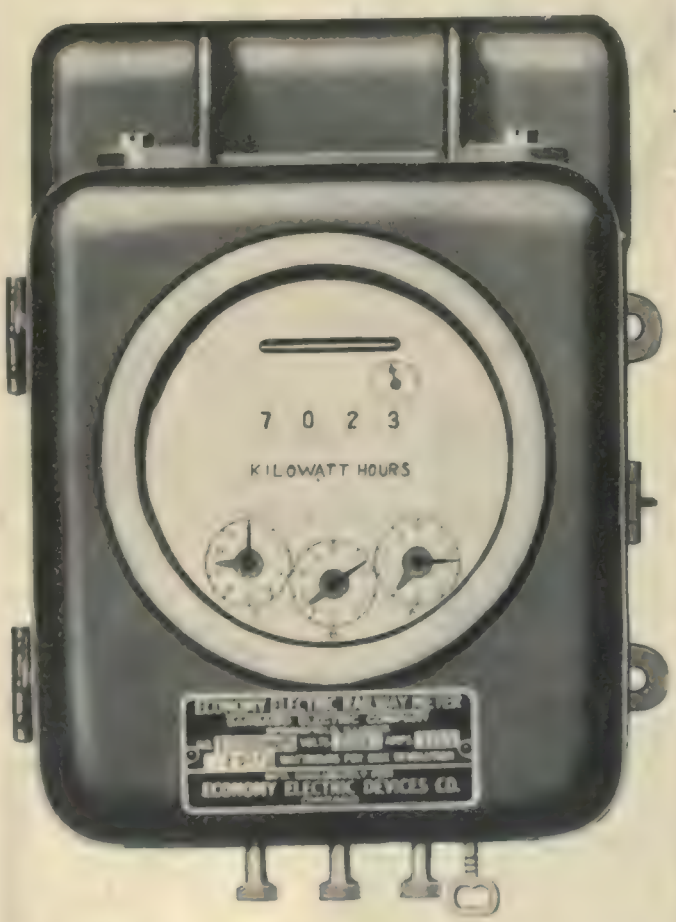
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Agencies throughout the World
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ACKLEY 2-E BRAKE

PHILADELPHIA

Car Inspection Dials on Economy Power-Saving Railway Meter

It Meters the Energy. That's what you want to save



The Watchdog of Your Power and Equipment

This is a rugged watt hour meter. Top dials for motormen's power-saving records. Lower dials for car inspection use.

When the meter-driven hand on dial A reaches the marker set for this car at 6, the barn man knows that the brakes and controllers have done their work and are due for an inspection equivalent to that otherwise made daily.

Likewise dial B shows when the car has done sufficient work to require oiling. This supplants the usual time or mileage period for oiling.

Dial C shows when the car has done sufficient work to require general inspection.

After any inspection the meter-driven hand is set back to zero by means of its reset rod at the bottom of the case.

A lock prevents unauthorized resetting of inspection dials.

The Economy meter with inspection dials is readily adaptable to any electric car or locomotive operating condition.

It is the only power-saving device whose unit is correct for use in determining when cars should be inspected.

The Economy Railway Meter saves Power and Car House Labor.

It is the only device that does BOTH.

Orders

There is no mystery about power saving with ECONOMY Meters

ECONOMY ELECTRI

Old Colony Buildin

RAPID TRANSIT ECONOMY METERS

Meter the Energy. That's what you want to save

This property through the use of Economy Meters, complete with Car Inspection Dials, will gain all the results obtainable from other checking devices and in addition will be able to reduce car house costs and obtain engineering and transportation data of high value.

As a Power Saving Device

Meter readings give the most accurate unit of comparison for the purpose of instruction and follow-up. The kilowatt hour is the direct unit of value, not a derivative which may or may not be a correct measure of operating efficiency.

Meter readings show the motorman the actual power consumption, and he can check directly the results of different methods of operation. *This induces savings.*

There is a direct connection between power consumption at the car and the coal pile at the station.

For Equipment Inspection

The kilowatt hour is acknowledged to be a better basis of inspection than either the time or mileage.

The meter gives an automatic continuous record of intervals and the chances of missing inspections are practically eliminated. *No clerical labor either.*

As an Engineering Device

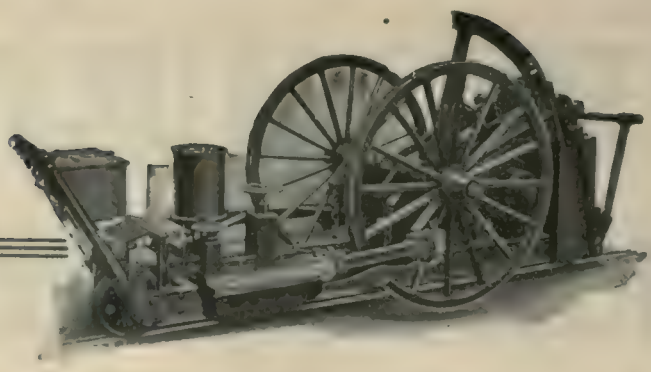
The meter furnishes data on power consumption of different types of equipment when operated under varying conditions. This information is of high value to the mechanical and electrical departments.

The actual power consumption of all cars on certain sections of track may be found by reading the meter on entering and leaving the section in question. This information may be used to determine the feeder capacities, condition of bonding, sub-station spacing, etc.

The meter affords an accurate means of measuring power when operating over foreign companies' tracks.

DEVICES COMPANY

Chicago, Ill.



Where Unskilled Labor Works as Well as Skilled Labor

It seems to be the feeling of some Electric Railways that in order to get successful Track grinding results a skilled mechanic is necessary for the operation of the Track Grinder

This is not so. The Reciprocating Track Grinder is so simple that after a few days' instructions any man on your track force can operate it with the greatest amount of success.

For those who still are pessimistic about the need of and the ease with which it can be used we offer to put a Reciprocating Track Grinder at work on your own tracks. This trial if you are not satisfied will cost you nothing. To make the test we will use your own men. This offer should interest you and we await your commands.

Largest manufacturer of both Reciprocating and Rotary Track Grinders in the World.

Railway Track-work Co.

3132 East Thompson St., Philadelphia

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To pull a large Pole in 8 minutes or to straighten any Pole in less than Two minutes use the

No. 328 Simplex Pole Pulling and Pole Straightening Jack



Templeton Kenly & Co. Ltd.

Established 1899

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Toronto
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There is a Simplex Jack for every Railway-Industry-Mine-Motor Car or Truck

A National Electrical Service
For Railroads

Western Electric
QUALITY PRODUCTS

Forty-three distributing houses, each maintaining complete stocks of every type of electrical equipment needed on a railroad

and

Forty-three service staffs ready to give prompt attention to orders—we specialize in emergency shipments.

Write our nearest house.

Western Electric Company

New York	Atlanta	Chicago	Kansas City	San Franscisco
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New Haven	New Orleans	Grand Rapids	Omaha	Portland
Boston	Richmond	Cleveland	Cincinnati	Spokane
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EQUIPMENT FOR EVERY ELECTRICAL NEED

Brady Brass Company

NEW YORK
95 Liberty Street

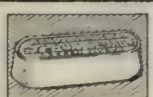
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Engine Castings for Rapid Velocities

Locomotive
Driving Boxes, Rods,
Tender and Truck Brasses
with a World-Wide Reputation

REFINERS OF THE FAMOUS CYPRUS BRONZE
(OUR OWN FORMULA)

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B	E	A	R	I	N	G
M	E	T	A	L		





Victor

During this period of rehabilitation many insulators will be needed by Electric Railways all over the country.

The value of your product is gauged by the service it renders. There is no more important factor in transmission line construction than the insulators—they must be suited to the conditions under which they operate.

Standardize your lines by adopting Victor Insulators.

Put your insulator problems up to us. We have solved harder ones than yours.

The Locke Insulator Manufacturing Co.
VICTOR, NEW YORK

MOTORMEN

can conserve energy in the operation of their cars only by increasing their percentage of

COASTING

which is accomplished by reducing standing time at stops and terminals, using one application of the brakes in making stops and prompt uniform operation of the controller in starting.

COASTING TIME

is the resultant of all operating factors under their control, and directly indicates the efficiency by which any required amount of energy was used in propelling cars.

RICO COASTING RECORDERS



Give the motormen printed records of their performance on a basis of true comparison, and in terms of measurement most effective towards encouraging them in the proper operation of the equipment and the attainment of maximum efficiency.

Increased Coasting Results in

Decreased Energy Consumption
Decreased Brake Shoe Wear
Decreased Equipment Depreciation
Decreased Accident Hazards
Decreased Schedule Delays

Investments in Rico Coasting Recorders on representative electric railways throughout the country, are netting returns of from 50% to 250% after defraying all costs of operation, including fixed charges and maintenance expenses. The narrow margin between gross revenues and operating expenses at the present time, emphasizes the desirability of increasing the efficiency of car operation to the highest possible degree.

We are pioneers in the development of efficiency checking devices and systems for economizing in the use of energy for car propulsion. Let us demonstrate the possibilities of increasing the net earnings on your road.

Time is the Essence of Railroading

RAILWAY IMPROVEMENT CO. RICO 61 BROADWAY, NEW YORK



TONCAN METAL

The ever-increasing demand for

Toncan Metal Corrugated Culverts

It is interesting to know that there is an ever-increasing demand for corrugated culverts made of Toncan Metal.

This fact is significant of the adaptability of Toncan Metal for culvert use. It proves that Toncan Metal is all we claim for it—that it is a super pure iron having wonderful rust resisting powers. Thousands of feet of Toncan Metal culverts are now in use under highways and railroads in this country and Canada. The condition of any of these culverts today is ample proof that Toncan Metal *does* resist rust. Installations, such as shown above, made years ago are still in use and show no signs of rust.

Toncan Metal Corrugated Culverts are ideal for every culvert service, as they combine strength with durability. Being light in weight they are easy to handle and haul. Unskilled labor can install them without danger of breaking. They can be used in any kind of soil—the deep corrugations hold them securely in place. As for strength, they will hold up under heavy loads—whether buried under a deep or shallow fill. And, above all, they are *permanent*.

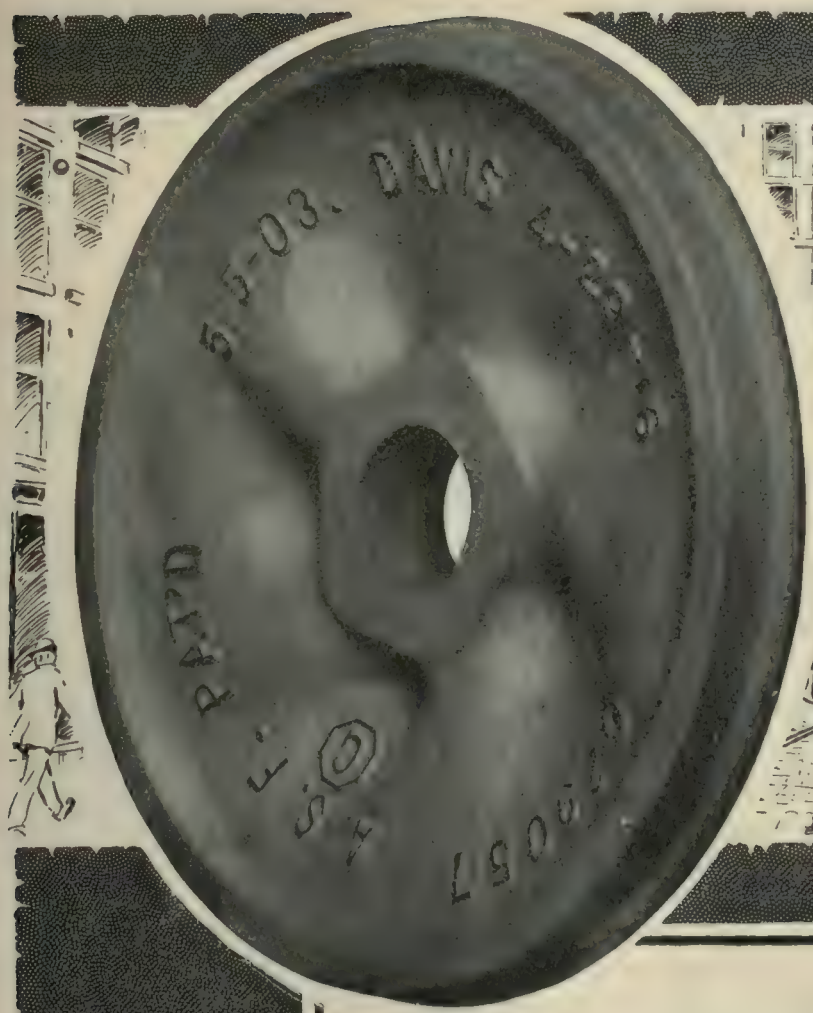
We will be glad to send the name of the nearest Toncan Metal Corrugated Culvert manufacturer.

Just drop a card to Dept. Q-21.

THE STARK ROLLING MILL COMPANY

—Sole Manufacturers—

CANTON, OHIO





TO withstand the stress and strains of high speed and heavy haulage, the sudden shocks from brake-shoes, track curvatures and crossovers—to withstand these conditions and reduce upkeep expense, specify Davis One-wear Steel Wheels.

American Steel Foundries

1100 McCormick Building

CHICAGO

DAVIS STEEL WHEELS

Cut Down Your Maintenance Costs

By Using

ROCKBESTOS

Asbestos Covered Magnet Wire



Rockbestos insulation is as durable as the wire itself and its employment insures generators, magnets, motors, solenoids, transformers, and electro-magnet windings of every description against burning out from any cause, thereby reducing the possibility of breakdowns to a minimum and doing away entirely with any need of the expensive and time-consuming process of rewinding.

Rockbestos covered wire and cable has a field peculiarly its own. It must be used where considerations of safety from destructive and severe temperature rises in electrical apparatus will not permit the use of the conventional forms of conductors insulated with inflammable or slow-burning materials.



If you will so indicate, we shall be glad to submit you samples of Rockbestos wire.

Marlin-Rockwell Corporation

Insulated Wire Division

New Haven, Conn., U. S. A.



Tape

Friction Tape and Rubber Splicing Tape are two products whose success requires a wide range of experience in both their manufacture and their application.

The United States Rubber Company not only has had the experience which is necessary to manufacture a successful tape for every trade and purpose, but also has a complete understanding of the requirements of the electrical trade.

We are endeavoring to pay strict attention to the needs of the electrical engineers and manufacturers and to co-operate with them in every possible way with the idea of giving them the greatest value for the amount invested.

The distribution of representative stocks of Friction Tape and Rubber Splicing Tape in our various branches located in every industrial center, insures an adequate and prompt delivery service.

United States Rubber Company

The World's Largest and Most Experienced Manufacturer of Mechanical Rubber Goods

UNITED STATES RUBBER COMPANY US RUBBER SYSTEM AND ASSOCIATED COMPANIES



Fleet of White Trucks owned by New York State Railways, Rochester, N. Y.

The Product of Experience

THERE is something which defies theory in the making of a successful truck. No blue print specifications can foretell its performance. Engineering skill alone cannot assure it.

The successful truck is the product of years of transportation experience under all operating conditions.

White Trucks have *grown* to be what they are. They do the most work for the least money because that has been the essential purpose in their development.

THE WHITE COMPANY
CLEVELAND

White Trucks



Keeping Abreast With the Times

The above picture shows the first Electric Cars used in this country and the picture at the bottom of the page the new one man Safety Car which is the latest type of car used today.

Note the great progress that has been made in these comparatively few years in Street Cars.

Just so has this progress been made in Galena Oils and Galena Service. Our research and engineering Departments have worked hard to keep one or two steps ahead of the times and today—just the same as in 1869 when our business was founded—we stand in advance of the progress of the times.

Galena Service is now working at maximum efficiency in the work of producing betterments in operation through scientific methods of lubrication.

When Galena Service Goes In, Lubricating Troubles Go Out!

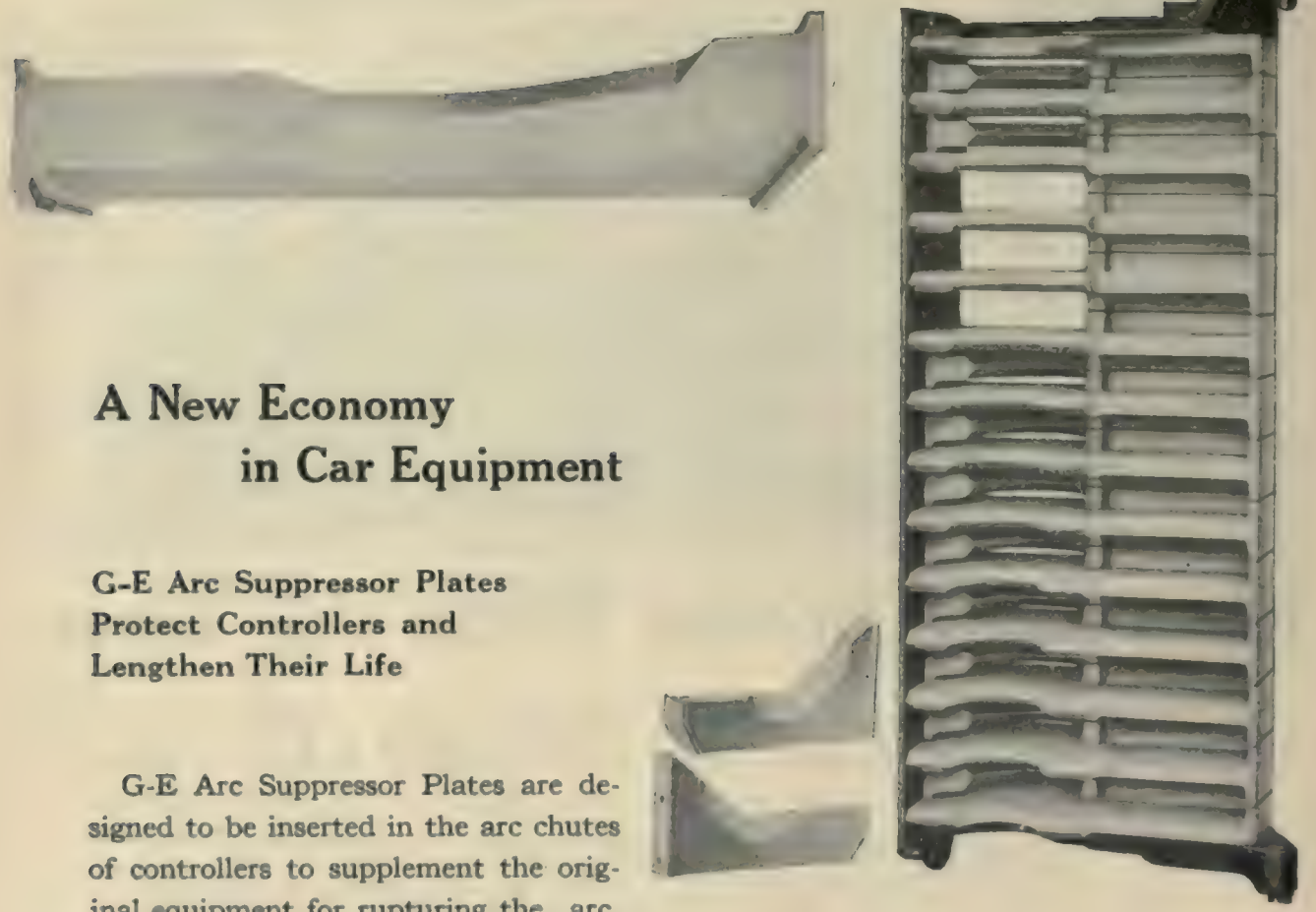


Galena-Signal Oil Company

New York Franklin, Pa. Chicago

Works at Franklin, Pa., Parkersburg, W. Va., Whiting, Ind., St. Louis, Mo., Bayway, N. J., Toronto, Can., Rouen, France

Offices in all principal cities of U. S.
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A New Economy in Car Equipment

G-E Arc Suppressor Plates Protect Controllers and Lengthen Their Life

G-E Arc Suppressor Plates are designed to be inserted in the arc chutes of controllers to supplement the original equipment for rupturing the arc. These plates double the effectiveness of the standard arc deflector, shortening the time for disrupting the arc with a resulting decrease in the burning of the controller fingers, segments and arc deflector plates. Controllers, therefore, wear longer and require fewer repairs and less frequent inspection as carbonization is greatly reduced and there is much less trouble from pitting of fingers and segments. The net result of applying these plates is a safer controller for the platform with longer life and cheaper maintenance.

G-E Arc Suppressor Plates are made of the same insulating material as the G-E arc chutes. They are inexpensive and can be used to advantage on any G-E controller with blow out coils on the individual fingers. A few minutes with three wood screws and a screw driver suffice to install.

Write us for a sample and prices

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

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Electric Railway Journal

Consolidation of STREET RAILWAY JOURNAL and ELECTRIC RAILWAY REVIEW

Volume 55 New York, Saturday, March 20, 1920 *Number* 12

"Merchandising Transportation Starts at the Carhouses"

THE above headline is quoted from the words of a leading street railway manager. To carry out this thought we may say that while platform men are important factors in merchandising transportation, the real place where transportation is sold is at the carhouses and repair shops. If a company will maintain cars well, keep them clean, paint them often, wash the windows, and make running gear as nearly noiseless as possible, a big step is taken toward obtaining many satisfied riders.

Try a line of well kept cars in parallel with a line of poorly maintained equipment, and see where the traffic goes. Maintenance tells the story and "sells the goods."

At Last Railways Begin Purchases on Large Scale

IT SEEMS almost too good to be true, but the fact is that, after years of enforced spendlessness, the electric railways are buying. It was shown in the markets columns last week that during the first two months of this year more than a third as many cars were ordered as during the entire twelve months of 1919. As was plainly predicted in our issue for Jan. 3, deliveries are rapidly lengthening.

It is true that the purchases now being made by electric railways are either to cut down cost of operation or to make necessary repairs. The interesting part, however, is that the roads are going ahead in these necessary expenditures. The market is awakening and, like a snowball, continues to gain in volume as it passes along.

Maintenance Costs Have Been Kept Well in Hand

THE annual maintenance issue of the ELECTRIC RAILWAY JOURNAL has developed year by year with the requirements of the industry until now it has become an epitome of the best in maintenance practice in all branches of the work. This year the editors have been unusually fortunate in getting the co-operation of men in all departments and in different sections of the country, for these men realize that they must give if they are to get. From Buenos Aires to Indianapolis, and from San Francisco to New Haven, have come the articles which make up the technical pages of this issue.

The maintenance problem is one of the most pressing that weighs upon the willing and sturdy, but sometimes over-tired, shoulders of the master mechanic, way engineer, overhead superintendent or power plant operator. He simply cannot get more money for his work to compensate for the increases in wages, the skyrocketing of material costs and the reduced efficiency of workers. The money "ain't thar." He therefore deserves great credit for keeping the wheels going under present conditions, and it has been only by the exercise of ingenuity and perseverance that this has been possible. This work is reflected in the present issue of the JOURNAL which, in turn, we believe, will make possible the still more rigid control of maintenance costs. To this end new tools, new methods and new spirit may be necessary during the coming year, but they will, no doubt, materialize as necessary.

New York City Plans to Start a Bus Line

NEW YORK CITY, which is receiving no return on some $250,000,000 that it has invested in rapid transit construction because it refuses to permit the companies to charge an adequate fare, is now proposing to go extensively into the bus transportation business. Two hundred buses are to be purchased for $1,140,000, and they will not only revolutionize the city's traffic problems and eliminate the street cars, according to an interview with one of the prominent members of the Board of Estimate which appeared in the daily papers the day following the vote, but the buses "will also afford to the City of New York an additional source of revenue which is much needed."

The latter part of the statement—that an additional source of revenue is much needed—is undoubtedly true. Teachers are leaving the New York public schools because they do not receive sufficient salaries, and real estate owners are complaining because of prospects of an increased tax rate. But we wonder how much net revenue the city expects to get from its buses with their 5 cent fares and with the rising prices for gasoline.

Why cannot New York settle its traction situation in a rational way? In other large cities in this country and abroad the fact is recognized that labor and materials have greatly increased in price and that some increase in railway fare must follow. In New York, the opposite attitude has been taken. The railway managements have been scolded in hearings and out of them; no attention has been paid to their requests for relief, and now the roads are to be "eliminated" by competition!

The idea that the city or any one else can supply a bus service at 5 cents a head under anywhere near the same conditions as regards headway, length of ride and safety as exist on the electric railways, is, of course, preposterous. It is being done nowhere else, and there is no reason to believe that it can be done in New York. In the meantime the citizens of New York are suffering from inadequate transportation because the companies which could supply these facilities are not permitted to charge a reasonable fare. Is it not time for some of the prominent civic bodies in the city to be heard in protest against this state of affairs?

Restricted Way Department Budgets Have Not Prevented Progress

THE activities in the way departments were greatly restricted during 1919. Our statistical issue of Jan. 3 indicated that both the items of new construction and reconstruction were the lowest recorded during the past ten years. In consequence there was but a limited opportunity for development of new methods or devices. While the new work was at a standstill, there was a necessarily large increase in the amount of work classed as maintenance. In the latter field effort was concentrated upon reduction of cost by improvement in method.

The scope of the arc welder and the rail grinder was extended and many a piece of track or special trackwork, which heretofore would have sought the scrap heap, was rehabilitated for long periods of further service. But there is a limit beyond which these saving methods may not go, and when we consider the small amount of reconstruction recorded for the past three seasons, there is every reason to believe that a fairly large amount of such work must be undertaken this year. Otherwise there will soon be a rather sudden and general breakdown of a very large track mileage, which will be most likely to occur in heavily-used, congested tracks where it can be least afforded from a revenue point of view. The indications, from rail and special trackwork inquiries now being received by the manufacturers, are to the effect that the absolute need for a more extensive program of track and special trackwork renewals during the current season is becoming increasingly apparent and that the gradually bettering income situation will result in greatly increased budgets for reconstruction purposes.

Increased programs may be faced with some degree of complacency in view of the greatly increased efficiency which has resulted from the efforts of way engineers to keep costs down in face of the constantly rising costs for both labor and material. By the introduction of machinery and through closer supervision, the engineers have been able to show an increased cost for track work of but 63 per cent, while the labor rates have advanced 124 per cent when both are compared with the costs and rates prevailing in 1914. No further proof of the value of machinery in track work could be asked for than the data given in the article by C. H. Clark in the issue of this paper for Feb. 21, 1920. Such results, nevertheless, will surely serve to spur those in charge of track matters onward in their search for further achievement in cutting the H. C. W. (high cost of work) as Mr. Clark so aptly puts it.

In reviewing the work of the way departments during the year 1919 we note several developments which are worthy of attention, since they show that the activities and research work of the way engineers have not lain dormant although retarded somewhat by the greatly reduced schedules which prevailed throughout that year.

In the rail-joint field, a service test installation at Pittsburgh was made of the resurrected type of electric-weld joints, under the comparatively new Jacobs patent which had been held back during the war period. It will be remembered that the original electric-weld joints were of the butt-weld type as devised by Elihu Thomson. These were succeeded by the electric bar-weld process after a short time, as it was almost impossible in that early day (1894) to secure uniformity of result with the butt welds as then made. Meanwhile, some of the earliest butt welds are still doing business, helping the rails wear out in operating tracks that are twenty-four years old. The new butt weld gives promise of producing the desired uniformity and the performance of the test installation will be watched with great interest by way engineers.

We have had occasion heretofore to call attention to the desirability of carefully selecting and training skilled labor. An editorial in the issue of this paper for March 8, 1919, pointed out that the training of this class of labor which is necessary for advancement must be furnished by the employer. That such educational steps are receiving increased consideration at the hands of those who are responsible for labor results, is evidenced by the inauguration of a training course for track foremen by the Denver Tramway. The need for competent track foremen has been increasingly noticeable of late. Apparently men are not born with the "track instinct" any more, and the older foremen have left the service to an extent which is tending to handicap the resumption of extensive outside work. There is no doubt that the training scheme as applied in Denver will be taken up in other quarters.

Meanwhile several large companies have been working along somewhat similar lines through the plan of holding monthly meetings of track foremen and supervisors at which track problems of an educational nature are discussed. Likewise there is a tendency toward the provision of illustrated books of instruction covering the principal methods of doing work properly, together with details of construction which are constantly used but often varied improperly through ignorance or neglect of the foremen. All this is along the line of "human engineering," an almost untried field in which there is promise of great results in efficiency and in betterment of mutual relations between the employer and employee.

Don't Worry If Automatic, Power-Saving and Safety Devices Increase Maintenance Costs

THE past year has seen an increased use of automatic, safety and power-saving devices in connection with electric car equipment. Each has its particular field of usefulness in producing economies. The use of automatic devices gives additional comfort to passengers and makes the duties of car operation more attractive. Economies are also produced through speeding up the service by increasing the accelerating and braking rates and by decreasing the duration of stops. Safety devices have reduced accident and damage costs, and power-saving devices have produced economies by proper and the most efficient operation of the equipment. These economies necessarily increase somewhat the budget of the equipment maintenance department.

The criterion in this matter is, of course, the total operating expense as compared with the gross revenue, but so many things are now contributing to increase maintenance costs that these are being scanned more and more closely. In this line it cannot be emphasized too strongly that comparisons on a car-unit basis and without regard to the number of pieces of apparatus that constitute the car equipment are sure to be misleading.

The superintendent of equipment not only finds that maintenance costs increase as the number of pieces of apparatus is increased but he also discovers that his men are not familiar with the new classes of apparatus

and that troubles result from this lack of familiarity. This brings the cars into the shop at more frequent intervals and overtaxes its capacity, so that the work has to be done under unfavorable conditions. These added burdens are not relished by the mechanical superintendent, and when the general manager asks him to explain why his maintenance costs per car-mile are higher than those of a neighboring road operating older types of equipment he curses the advent of modern appliances which are of advantage to the operating department only and longs for a return to the old days and the old class of equipment, as was so aptly explained by a contributor in the issue of this paper for Feb. 7.

If the maximum usefulness from these devices is to be had they must be maintained in a high state of repair, and this requires enthusiasm for their use and co-operation from the men in the mechanical department. The savings resulting in directions other than maintenance are so great that the additional cost of repairs and inspection is readily absorbed. The maintenance men are quickly convinced of the usefulness of the new devices and if the men a little higher up will recognize at once that additional forces and facilities are necessary to take care of the added equipment and in making comparisons of costs will consider the number of pieces of apparatus on a car as well as the car-miles operated, a closer agreement will be reached. Any comparisons made of the efficiency of conducting the mechanical department before and after the new devices are installed must show an increase in cost per year but when the number of pieces of equipment is considered, an increased efficiency will no doubt be evident.

Kansas City Again in the Foreground

FOR a clean, straightfoward discussion and appreciation of the problems of local transportation, the report to the Kansas City Chamber of Commerce just made by its Committee of One Hundred, is certainly to be commended. As with other cities, there was a street railway problem, not only from a traffic standpoint, but from the more general situation arising from the increases in all costs of operation which made the former fare unprofitable. To Kansas City the question seemed a commercial one, and not a political matter and, as such, one in whose solution the Chamber of Commerce could and properly should take an active part. Kansas City has many hard-headed, clean-thinking and square-dealing business men and the summary of recommendations made by this committee evidences the clear analysis and hard work that has been put upon the study of the question. Kansas City tackles most of its problems from the standpoint of the city's best welfare. Its politics sometimes prevents the realization of its desires, but times are improving. The people are for fair play.

This committee states its purpose thus: "From the beginning of the investigation to the final recommendation in this report, the committee has been guided by the principle of justice. First, to the car rider through good service at a reasonable fare; second, to the street railway employee through a just wage; and last, to the street railway investor, through confidence in a just and sure recompense."

The principal recommendations are: A service-at-cost principle with a variable fare and an inverse variable return on capital with a minimum of 6 per cent; the entire remission of any charges against the railway for paving, street cleaning, licenses, snow removal, etc.; a complete co-operation between city and company to improve service; a Kansas City chairman of the Board of Directors, and some financial details of special local interest. On the surface it seems that this platform should appeal to all fairminded folks. It is an earnest of the present day attitude in a progressive American city. We hope that the results in this case will not fall short of the anticipated satisfactory solution for all concerned and that this will prove to be another leading forerunner of many other cases of thorough understanding of the transportation problem. The Chamber of Commerce voices this same hope and feels its responsibility, for it calls attention to the several similar investigations under way, some national in character and scope, of which this is about the first to result in a published analytical report.

Electrification Studies Get Impetus at A. R. E. A. Meeting

AS THIS issue goes to press, the twenty-first annual convention of the A. R. E. A., is in progress with a large attendance after the detracting influences of the last two years. The volume of matter to be presented to the association through committee reports exceeds that of any previous year, and the delegates seem to be expressing their pleasure in the return to private operation by an unusual manifestation of interest. President Earl Stimson perhaps sounded the key note of endeavor for the next few years in two statements in his address. First, he pointed out that the immediate concern of the engineers is maintenance rather than construction. Beyond that, he intimated the trend of much construction work when he spoke of the great interest centering in the report of the committee on electricity, because of the "consideration being given to the subject of electrification by so many roads as a matter of economy in operation and as a means of increasing the capacity of present facilities." There is evidence also in the report of the committee on electricity that the work of electrifying the steam roads is to receive a great impetus in the next few years, for the economies that will thereby result are more necessary now than ever before, if private operation is to be made permanent.

This committee also makes the statements in its report (1) that 110,000-volt transmission line and 3,000-volt trolley potentials are practicable and reliable for electric railway service for 100 miles or over of single track; (2) that such a system of electrification will increase the capacity of a road 25 to 35 per cent; (3) that such a system will prove more economical if traffic is favorable for electric operation; (4) that electric locomotives with regenerative braking have made possible the haulage of heavier trains at higher speeds on mountain divisions with greater safety and reliability under all climatic conditions. This would seem to indicate that the attention of the steamroad engineers will be earnestly turned to the possibilities of electrification and, in fact, has already been directed to this problem on a great many roads. No greater service looking toward the conservation of the nation's resources on the one hand and the well being of the railroads on the other could be done than for the A. R. E. A. to get solidly behind this movement and bring out the full possibilities as applied to each and every railroad.

Maintenance Practice of the Anglo-Argentine Tramway—I

Consolidation of Eleven Operating Companies Offered a Fine Opportunity for Standardization of Cars, Equipment, Tools and Maintenance Methods

BY R. FRANCISCO APESECHE
Assistant to Chief Engineer Anglo-Argentine Tramway, Buenos Aires, Argentina



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CARS LEAVING PLAZA MAYO, BUENOS AIRES, ARGENTINA

BUENOS AIRES has a street railway system that can compare with the best operated and largest in the world. The Anglo-Argentine tramway system presents to anyone interested in street railway work an opportunity to study and appreciate the great progress that this company in its nine years of operation has made, not only in its well-maintained physical property but also in its harmonious operating organization.

The electrification of the several street car companies that were operating in Buenos Aires began in the year 1897 and was finished in 1906. In 1908 there were eleven street car companies in Buenos Aires, but during that and the following year, eight of the most important were fused into the Anglo-Argentine Tramway Company, which resulted in the most extensive street railway system of South America. A straight fare of 4½ cents ($0.10 Argentine money) was charged with a special fare of 2.2 cents ($0.05 Argentine money) for workingmen during certain hours of the day. In 1911 the construction of the first of the underground lines of the company was started and these were finished in 1913.

Buenos Aires is a fairly level city and the company's tracks have very few grades. The accompanying map shows the surface and underground lines now in operation, as well as the situation of substations, carhouses, operating carhouses, etc. The Anglo-Argentine Tramway has 390 miles of single track; 368 miles located within the city limits. Of this 9 miles is used by the underground line. The gage is 4 ft. 8½ in.

With a rolling stock equipment of 1,750 motor cars, 870 trailers, and 84 subway motor cars, this system serves a population of 1,700,000, and carries 318,000,000 passengers annually on its surface lines and 32,000,000 passengers on its underground line.

The result of the consolidation was that the newly-formed company came into possession of a great variety

of car equipment, trucks, bodies, motors, control equipment, gears, brakes, etc., and as great a variety of shop equipment and maintenance methods.

At the time of the consolidation, the rolling stock of the company consisted of 1,399 open-platform motor cars, 630 trailers (of which 283 were open) and twenty-eight general work cars. In this stock we had double and single-truck cars of twelve different types, fifteen types of body of one and two decks and with a capacity ranging from 22 to 46 seats, eight types of non-ventilated motors of 20 to 30-hp. capacity, and eight types of equally as primitive controller equipment.

As we have very few cars with double trucks, and very few miles of interurban track, practically all surface double-truck cars have been changed to the single-truck type, the Brill 21-E single truck having been adopted as standard. This carries a standard body 31 ft. 2½ in. long over canopies and 8 ft. 2½ in. wide over pillars, with two operating platforms and a seating capacity of 32 persons. The car fully equipped weighs 12 tons. Accompanying illustrations give details of our standard motor car.

The motor equipment comprises two Dick Kerr 3A4, or two A. E. G.-67A motors with A. E. G.-B8gm controllers or A. E. G.-U140, or two A. E. G.-U158 interpole motors with A. E. G.-B30gm controllers. The last-named motors are of the semi-ventilated type, of 40-hp. capacity. Cars are provided with both hand and electric brakes, but the electric brake is used only in emergency.

All cars that undergo the general reconstruction, which is given to each every ten years, are rebuilt according to the standard adopted. To all cars not scheduled for reconstruction within a short time, a regular standardization process is applied during the general overhauling that takes place every eight months. This includes remodeling the braking mechanism, windows, lifeguards, lighting system, and changing the position of cable hose, etc. Every year the platforms of a certain number of cars are enclosed. At present 30 per cent of the motor cars have closed platforms; of these one-fourth are new cars imported from England, and the rest are cars rebuilt or newly built in our shops.

For the first three years after the consolidation very little was done scientifically to organize the rolling stock department. At the beginning of 1912 the first steps were taken to introduce a rational system of inspection and overhauling that would make possible the prevention of failures by detecting and repairing small defects that otherwise would have developed into larger ones. Lack of this attention would require us to keep the cars out of service for a longer time, increasing the cost of the repair and increasing the working force at the carhouses. To arrive at this result it was necessary first to organize the working forces at the operating carhouses. Previous to 1912 every carhouse had two chief foremen, one for day and the other for night duty, since as much work was intended to be done at night as during the day. These two chief foremen with their corresponding assistants were exchanged every two weeks, with very prejudicial results to the work carried out due to the antagonism developed between them. The result of this inefficient system went even farther in the way the repairs were made, due to the lack of knowledge and of instruction of the foremen in charge of the work.

The fifteen operating carhouses, now reduced to eleven, were divided into three groups of five each. Each group was placed under the supervision of a roll-



MAP OF THE ANGLO-ARGENTINE TRAMWAY COMPANY'S LINES, BUENOS AIRES

ing stock inspector selected from among the best of the chief foremen. The inspectors visit the carhouses daily, and act as assistants of the chief of the department. They report every other day to the rolling stock chief and receive at the same time the instructions and explanations that have to be given to the chief foremen. Each operating carhouse is under the immediate direction of a chief foreman, assisted by two shop foremen, one for the day and the other for the night, who are exchanged every two weeks. The force consists also of a first mechanic who takes the place of either foreman in case of absence, repairmen, electricians, brakemen, painters, oilmen and general repairmen, the distribution depending on the number of men in each classification and the importance of the operating carhouse. The average working force is 35 men per carhouse, excluding the car cleaners, who, although under the supervision of the rolling stock department, belong to the traffic department.

A book of rules and instructions is given to every chief foreman and assistants in which all work done at the carhouses is detailed and explained. This contributes greatly to the standardization of the maintenance work. The company has a general shop but, due to the

TABLE I—COMPARATIVE STATISTICS OF THE ANGLO ARGENTINE TRAMWAY ROLLING STOCK OF THE SURFACE LINES ONLY

Car Mileage—Car Pull-In—Energy Consumption

Description	1911	1912	1913 *	1914	1915	1916	1917	1918
Motor car mileage (in thousand miles)	41,450	42,900	45,000	42,500	42,350	42,400	43,100	43,200
Total mileage motor-trailer (in thousand miles)	52,000	53,750	57,350	54,600	53,500	53,900	55,000	55,800
Total cars pull-in	14,730	7,218	3,128	3,242	2,140	1,489	1,206	1,000
Cars-miles per pull-in	2,860	5,830	14,380	13,250	19,750	28,500	35,800	45,200
Number of motor cars in service (maximum daily average)	....	....	1,413	1,287	1,197	1,184	1,205	1,211
Miles per motor car (daily average)	....	....	88	91	97	98	98	98
Hours of delay due to cars pull-in	968	722	284	270	198	136	150	145
Hours of delay due to cars derailed	530	863	625	343	120	49	45	40
Total energy consumption per car-mile: kilowatt-hours	1.125	1.1	1.01	0.977	0.954	0.954	0.97	0.98

* In December of 1913 the first subway was inaugurated which justifies the drop of mileage in the following years.

TABLE II—COMPARATIVE STATISTICS OF THE ANGLO ARGENTINE TRAMWAY ROLLING STOCK OF THE SURFACE LINES ONLY

Electrical Equipment—Parts That Have Been Repaired or Replaced

Description	1911	1912	1913	1914	1915	1916	1917	1918
Armatures, open-circuited	1,262	580	265	161	105	75	56	76
Armatures, short-circuited	929	592	313	292	169	108	105	104
Field coils, burnt	2,161	1,557	277	186	106	51	38	69
Armatures repaired	2,492	1,921	1,414	577	575	549	554	423
Armatures rewound	1,311	968	527	387	208	181	179	141
Field coils replaced and repaired	6,986	4,480	1,667	600	388	363	242	209
Field coils rewound	2,823	1,565	922	384	207	....	....	..
Circuit breakers	..	1,564	..	..	435	520	174	66
Power switches	..	824	..	....	222	204	168	87
Power fuses	76,425	49,797	31,239	18,080	7,525	7,200	7,120	5,897
Carbon brushes	..	40,325	29,163	19,138	15,382	17,292	8,008	9,139
Controller finger contacts	....	17,460	28,550	14,624	10,331	10,536	10,151	6,996
Controller segments	..	20,857	37,499	20,227	15,849	12,786	6,967	7,399
Electric lamps	....	105,347	98,335	57,360	37,721	32,948	26,569	22,695
Number of trolley wheels	8,999	8,841	10,126	6,918	3,248	2,071	2,571	2,904
Service mileage per trolley wheel	4,600	4,850	4,430	6,150	13,000	20,500	16,750	14,880

TABLE III—COMPARATIVE STATISTICS OF THE ANGLO-ARGENTINE TRAMWAY ROLLING STOCK OF THE SURFACE LINES ONLY

Consumption of Lubricants and Bearings

Description	1911	1912	1913	1914	1915	1916	1917	1918
Pounds of lubricants per 1000 car-miles	..	6.7	5.48	4.69	3.365	3.01	2.125	1.9
Cost of lubricants per car-miles in dollars	..	$0.341	$0.308	$0.267	$0.191	$0.169	$0.152	$0.14
Motor bearings	..	4,003	2,120	1,373	876	1,101	729	750
Armature bearings	15,360	19,394	16,134	8,799	4,914	3,542	3,919	4,620
Journal bearings (motor and trailer)	..	6,454	3,542	3,132	2,538	2,170	1,943	1,554
Car-miles per motor bearing	..	42,900	85,000	130,000	193,500	154,000	247,000	231,000
Car-miles per armature bearing	9,560	8,870	11,250	19,700	34,400	48,000	44,000	37,500
Car-miles per journal bearing (motor and trailer)	....	32,400	64,700	70,000	84,400	99,500	113,200	111,200

TABLE IV—COMPARATIVE STATISTICS OF THE ANGLO ARGENTINE TRAMWAY ROLLING STOCK OF THE SURFACE LINES ONLY

Axles, Wheel Tires, Gears, Pinions and Brakeshoes Replaced

Description	1911	1912	1913	1914	1915	1916	1917	1918
New tires	..	4,377	2,658	2,452	2,122	1,155	880	971
Tires sent to the general shops to be turned	..	3,294	3,904	3,718	2,798	1,495	1,912	2,153
New axles	..	871	650	416	490	249	196	256
Gears	..	1,217	623	585	426	305	222	230
Pinions	..	3,335	3,459	2,835	1,960	1,204	1,224	1,186
Brakeshoes	..	42,124	41,035	35,52	23,467	20,548	19,413	16,149
Miles run per new tire installed	..	39,210	67,800	69,300	79,800	146,800	196,000	178,000
Miles run per new axle installed	..	98,400	138,500	207,000	172,800	354,000	439,000	368,000
Miles run per new gear installed	..	71,000	144,500	146,400	198,000	279,000	388,000	375,000
Miles run per new pinion installed	..	25,600	26,000	30,400	44,200	76,400	76,200	72,800
Miles run per new brakeshoes installed	....	4,080	4,380	4,820	7,220	8,260	8,930	10,710

TABLE V—COMPARATIVE STATISTICS OF THE ANGLO-ARGENTINE TRAMWAY ROLLING STOCK OF THE SURFACE LINES ONLY

Most Important Works Done to the Surface Line Cars in the Company Work Shops

Description	1911	1912	1913	1914	1915	1916	1917	1918
Total number of motor cars at close of last year *	..	..	1723	1768	1800	1814	1798	1731
Total number of trailer cars at close of last year †	..	..	790	818	835	831	853	889
Total number of special cars at close of last year	..	..	12	13	13	13	13	13
Total number of working cars at close of last year	..	..	78	77	83	83	82	82
New cars bought (erected at company shops)	..	..	..	46	64	24	16	..
Cars totally reconstructed (new body) *	..	..	37	30	..	..	..	15
Trailers totally reconstructed	..	..	..	40	..	..	46	..
Cars generally repaired without inclosing platforms †	..	..	..	..	112	139	92	41
Cars generally repaired including inclosing of platforms †	..	..	202	99	18	35	14	18
Construction of special cars for different purposes	..	..	..	2	..	..	..	..
Trailers generally repaired without inclosing platforms	..	..	99	33	64	22	58	..
Motor cars transformed into trailers	..	..	..	..	20	10	25	50
Cars painted anew	..	..	189	138	125	190	109	77
Trailers painted anew	..	..	15	80	59	25	58	..
Cars half painted, retouched or varnished at the carhouse	..	..	875	1066	863	644	913	668
Trailers painted, retouched or varnished at the carhouse	..	..	438	346	416	301	328	336

* These cars use the mechanical and electrical equipment of other cars, but their body is built totally anew.
† These cars are partially or totally dismantled, the parts in good condition are used again; advantage is taken to standardize them.

lack of organization, much work that could be done better and more cheaply at this shop was formerly done at the operating carhouses. Steps were taken to centralize as much as possible all heavy repairing and manufacturing at those shops where first-class machinery is available and where it is possible to have fewer but more skillful workmen under the immediate supervision of specialist foremen who can give all their attention to the production of better work with less labor cost.



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SUBWAY ENTRANCES, AVENUE MAYO, BUENOS AIRES

Although the car equipment maintenance organization was established during 1912, the present organization is the result of careful experimentation and study. Modifications have been introduced from time to time to assist in keeping the rolling stock in such condition that good and efficient operation is possible and to effect the greatest economy in maintenance.

The inspection of the car equipment is done at regular time intervals. Although the mileage basis is theoretically the most rational, the regular time interval is practically the best for our conditions. The mileage run by the different cars of any of our carhouses does not vary more than 5 per cent; therefore by using the time-interval basis we get the advantages of the mileage system, and clerical economies also result.

The frequency of the inspection periods and of the general overhauling periods must be determined by the length of time that the different parts of the equipment can work in an efficient and economical manner. This frequency can be decreased by the improvement in bearing materials and lubrication methods, by the use of modern types of motors and in general by a very conscientious inspection organization which thoroughly instructs the men how to do the work and holds them responsible for failures that could have been avoided had they done their work carefully.

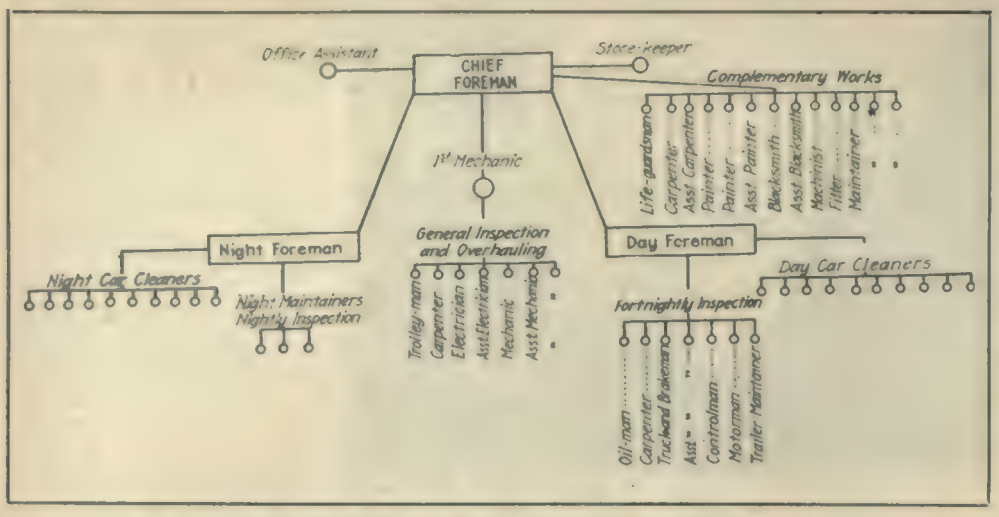
The results obtained after seven years of scientific maintenance can be judged by the statistics given in Tables I, II, III, IV and V.

The maintenance cost per car-mile has been reduced



TYPES OF THE ROLLING STOCK USED

1. Standard motor car, closed platform, thirty-two seats.
2. Open platform motor car, thirty-two seats.
3. Open platform trailer, thirty-two seats.
4. Closed platform trailer, twenty-eight seats.



CAR MAINTENANCE ORGANIZATION CHART

35 per cent since 1912, which means that our rolling-stock maintenance expenses in 1917 were $500,000 less than in 1912. The miles run per pull-in increased from 2,860 in 1911 to 45,200 in 1918. The maintenance work done in the car shops can be divided into four general classes: (1) The general overhauling which is determined by the life of the armature bearings. By the use of better material the overhauling of the cars is now done every eight months where previously it was done every four months. (2) The lubrication inspection and brief inspection of all mechanical and electrical equipment made every two weeks. This period of time is kept for the lubrication of some of the parts of the car equipment, but it has been increased for others, as the result of the use of better lubricants and lubrication methods. (3) Nightly inspection, without repairing during the night. (4) Supplementary work, such as repairing wrecked cars, changing wheels and gears, painting, emergency call answers, etc.

The work has been planned in a very systematic way. Each man knows what he is going to inspect, how to go at it and how to repair it in accordance with the book of rules and instructions. The accompanying diagram shows the organization of an operating carhouse.

Results With High-Speed Turbines

A writer in the current issue of the *General Electric Review*, in summarizing the present situation regarding high-speed, high-capacity steam turbines, notes that machines of 50,000 kva. operating at 1,200 r.p.m. have been built and are operating satisfactorily. Machines of 38,889 kva. at 1,500 r.p.m. have also been built and are in successful operation. In the 1,800 r.p.m. class, there are a number of machines in commercial service with ratings of 31,250 kva. at 0.8 p-f., and 33,333 kva. at 0.9 p-f., while at the highest speed, viz., 3,600 r.p.m., machines of 7,500 kva. are in operation, and two of 9,375 kva. are under construction.

The American Institute of Consulting Engineers has made a protest against the entrusting of the design of bridges by public bodies to architects. As a class, the protest says, the external architectural treatment and decorative effect in such structures is secondary in importance to the engineering design, which should provide safety, adaptability and durability of construction.

Bureau of Standards Studies Rail Joints

THE Bureau of Standards has published a new edition of its bulletin on modern practice in the construction and maintenance of rail joints and bonds in electric railways. The author, E. R. Shepard, states among his general conclusions that the most important tendency as revealed in the investigation upon which the report is based is the attitude the companies are now taking toward the whole subject of bonding. That it is an engineering problem deserving of as much skill and attention as any other problem in connection with the operation of an electric railway is apparently being realized by the large majority of the railway engineers. There is a marked tendency to get away from all types of soldered bonds which, even in recent years, have been installed in great numbers. A few companies who employ thoroughly experienced and capable workmen still continue to use them, but the number is relatively small.

Practically all types of standard modern bonds, when selected to meet local conditions and installed according to the best practices will give satisfactory results with an almost negligible percentage of failures on joints which are properly maintained. The problem of rail bond maintenance is largely that of joint maintenance. No bond can be expected to last continuously on a loose and poorly supported rail joint. No one type of bond can be said to be better than all other types. Each has its advantages and disadvantages, and the selection of a bond for any particular service should be governed by the type of construction on which it is to be used, the grade of labor available for installation and numerous other local conditions.

While welded joints are being used more than ever before, there is a growing tendency to adopt improved mechanical joints and various forms of special joints, several of which are a combination of welded and bolted or welded and riveted joints. These special joints seem to be meeting the demands of service with fewer failures and better results generally than any of the standard types.

It has been demonstrated that the saving of power alone would not justify the best modern practice in bonding. Such practice, however, is justified and strongly recommended from the standpoint of good voltage conditions in the return circuits, which not only make for good electrolysis conditions but also for more satisfactory operation.

Attention is again called to the fact that the problem of track bonding is still in a state of evolution. New inventions and improvements in methods and practices have been so frequent during recent years that many types of bonds and joints can still be said to be in the experimental stage. Carefully kept records and a free interchange of experiences on the part of the operating companies will do much toward the establishment of definite and standard practice in this particular field.

Low-First-Cost Low-Maintenance-Cost Track

Tampa Electric Company Has Had Wonderful Success With a Unique Type of Construction—The Life Is Unusually Long, Joint Repair Is Infrequent and Corrugation Is Unknown

THE Tampa (Fla.) Electric Company enjoys a unique position in connection with the character of track construction which it has employed with unusual success. While the construction is very different from that used anywhere else, in the knowledge of the writer, it is certainly justified by its low first cost of both track and paving, its low maintenance cost, the great ease with which it can be opened up and repaired when occasion demands, its freedom from corrugation and the low noise feature. The same general type of construction has been used by the company for twenty years and there are now about 40 miles of it in service. A piece of track on Ninth Avenue, between Thirteenth and Fifteenth Streets, laid with 56-lb. rail, has been in continuous regular service for twenty years. This had to be opened up once at the joints and the fish plates renewed or repaired, but the same rail and subgrade construction and the same brick paving—the first done in Tampa—are still in service. The secret of the whole track plan lies largely in the sandy character of the soil.

In general, the construction comprises 5-in. A.S.C.E. 80-lb. rails laid on wood stringers supported on cross ties, and making use only of sand for ballast and for track and paving foundations. As far back as twenty years ago, in connection with the first paving jobs done by the street car company, the city was about to force the company to put in a concrete foundation for the track and pavement, and in fact had ordered this. It came about because, with the use of the 5-in. rail, there was not sufficient foundation material between the pavement and the top of the ties and the bricks would settle between ties, making a wavy surface along the rails. The company, however, was very desirous of retaining the 5-in. standard T-rail and to this end tried out the plan of mounting the rails on stringers. This arrangement gave a good depth of sand between the paving and the tops of the ties and apparently eliminated the objection. The city was then induced to accept this stringer construction in lieu of a concrete substructure as ordered and it has been in use ever since. Some experimenting has since been done with a 7-in. T-rail, but there was no need to put this on stringers and yet the construction seemed to be very unsatisfactory without stringers, so that the use of the high T-rail was abandoned.

Details of Construction

In building this type of track, the trackway is excavated to the proper depth and 4-in. x 8-in. cypress cross ties laid at about 2-ft. centers. The stringers



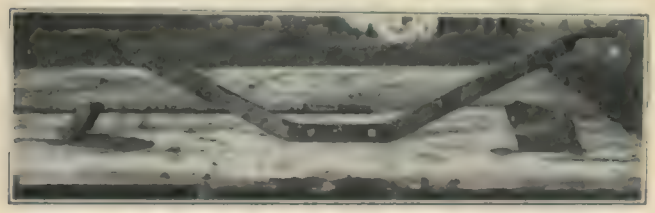
TYPICAL SURFACE APPEARANCE OF TAMPA'S TRACK AND BRICK PAVING



A STRETCH OF TRACK AND PAVEMENT ON NINTH AVE. STILL IN USE AFTER TWENTY YEARS

are then laid on the ties and four 60-dwt. spikes toe-nailed into each tie, two on either side of the stringer. The ties are then tamped up to grade with sand and the stringers lined up so that the rails can be spiked to gage at the center of the stringers. The stringers are 8-in. x 10-in. x 16-ft. cypress timbers and the rails are spiked to these with reverse point spikes. Six-bolt continuous rail joints are used and these are held in place by Harvey grip-nuts and bolts with no washers. Concealed soldered bonds patented by T. C. Folsom, roadmaster, installed underneath the fishplates are used on new work but not on repair work because of the cost of removing the fishplate. In repair work, therefore, an electric welded bond is placed on the head of the rail.

Among the unusual features of the track is the use of a peculiar design of tie rod, a picture of which is shown herewith. These rods are spaced every 15 ft. and used in conjunction with a special rail brace shown in the same picture. The ordinary tie rod was found to be in the way of the paving, causing a bad joint in the bricks. Mr. Folsom therefore developed this tie rod made of ⅜-in. x 1¼-in. strap iron, and having a 10-in. downward offset in it. At each tie rod location one of the special rail braces is installed. This is placed underneath the base of the rail with the brace part fitting underneath the rail head on the outside of the



SPECIAL RAIL BRACE AND TIE ROD USED IN TAMPA

rail. It is held in place by two spikes driven through the casting. The base of the brace extends underneath the base of the rail and projects beyond the stringer, and the tie rod rests on and is bolted to this base. A half turn at each end of the tie rod brings the flat surface in contact with the brace at the ends, and with the side of a tie, at the center. At the center of the rod, two square holes are punched so that it may be spiked to the tie.

After the rails have been spiked to the stringers and surfaced and aligned, the track structure is filled in with sand and then flooded with water and tamped down thoroughly. No other ballast is used except in low wet places. The bricks are then either tamped by hand or rolled with a heavy roller. Thereafter, the paving and track construction are permitted to settle for some time, after which any low spots developing are leveled up and then the bricks grouted in.

In special work locations, the rails are laid on 8-in. x 14-in. pine stringers because the spikes seem to hold better in pine than in cypress. On curves, 8-in. x 12-in. x 10-ft. pine stringers are used, the 10-ft. lengths being short enough to provide for the curvature.

Cypress costs about the same as pine but lasts much longer. In damp places, the cypress will last indefinitely. Its average life is about fifteen years in closed track. The life of cypress cross-ties laid in open track on one of the company's suburban lines has been found to be from ten to twelve years. One piece of track built as described above with cypress ties and stringers was taken up after it had been in the ground ten years and the timber was found to be all sound. It was used again and has now been in the ground ten years more, with no evidence of deterioration to date. The ties and stringers used by the Tampa company are not treated but are all heart, and locally grown.

One of the interesting things in connection with this track construction is that corrugation is absolutely unknown. Mr. Folsom also states that cases of joint trouble are very rare, and of course when there is a low joint to be repaired, the process of opening up the track and getting at the joint is so simple that the cost is very low. The entire track structure seems to hold its alignment and grade and remains in good condition with remarkably little maintenance, though subjected to a rather frequent service of large double-truck summer cars and Birney cars. The absence of extreme cold in winter and of marked changes of temperature have a bearing on this, no doubt. The initial construction cost is also very low, of course, running in the neighborhood of $1.50 a running foot of single straight track, exclusive of special work but including paving.

Welding Steel Poles

BY G. H. MCKELWAY
Engineer of Distribution Brooklyn Rapid Transit System

THE USE of electric welding equipments has become very common on many railway properties, but their use has nearly always been confined to work either on the track or in the shops, with some little use by the electrical department in connection with the maintenance of equipment in the power or sub-stations.

The writer has never seen any description of the use of such equipments by the line department, although he knows of at least one case where it was proved that they could be satisfactorily used in the work of that department. This was in the building up of weak points in old steel tubular poles. Many poles after being in service for a number of years become rusted at the joints or near the ground line due to moisture collecting there. This is particularly true of poles on which iron collars are used at these danger points. The practice of applying such collars was at one time much more common than at present, as they were then considered to add to the appearance of the pole.

The writer was interested in some work which was done at the line department yard of this company on poles which had been removed from the ground. The job consisted of depositing a layer of metal from the welding rods in the groove which had been made by the rust and which was first cleaned out before the arc welder was used on it. While the work was entirely in the form of an experiment to see what could be done there was no doubt, at the conclusion, that it could be done satisfactorily and the life of the pole increased thereby. In fact, there seems to be no reason why such work could not be done on the poles while they were still set in the ground, although it would be difficult to perform it from ladders, and a more secure working platform would probably have to be provided for the welders.

M. O. Leighton, chairman of the National Public Works Department Association, addressed a meeting of members of the National Engineering Societies in New York on Feb. 19, on the desirability of a department of public works. A hearing on this plan was given on Feb. 11 by the Senate committee on public lands.

Economy in Car Painting

Reduced Costs of Car Painting Do Not Result From Using Cheap Material or Labor—Analysis of the Causes of Paint Failure Show that Many Might Be Avoided by Using a Little More Care

BY DENNIS O'BRIEN
Foreman Painter Brooklyn (N. Y.) Rapid Transit Company



CONVENIENT OIL STORAGE IS A GREAT HELP TO THE PAINTER

THE high costs of paint, oil, and labor have made it necessary for railway organizations to economize in the painting of their equipment. Economy in painting does not result from buying cheap material. A manufacturer or salesman who offers a gallon of oil paint or enamel for $2, when oil is selling around $2.25 per gallon and who says, respecting it, that it is pure linseed oil paint, should be branded as a fraud. A good paint, well ground, whose vehicle is pure linseed oil will have a greater spreading rate under the brush, that is, it will cover more square feet of surface than a cheap, poorly ground paint the vehicle of which is a linseed oil substitute.

In order to get longer life from the paint used we must eliminate the small defects, as it is these small defects which usually lead to larger ones. We find in the last analysis that failure is due to defects which might have been overcome had we exercised a little care and prudence.

The causes of paint failure are two-fold; unpreventable and preventable. The unpreventable causes are moisture, sulphur compounds, ammonia, acids and carbon monoxide. These are found in the atmosphere of large manufacturing cities, and it is a problem for the paint chemists to make a combative paint. The preventable causes are poor workmanship, improper mixing, improper foundations and improper drying conditions. These are directly up to the painter and the paint department.

The trade of car-painter is too often supposed to consist of manual processes only. It is thought by many that a young man has only to follow others in order to become a competent workman. There is, however, an element of technique that obtains in painting as in every other trade; it is this that the foreman must impart to the mechanic and he must never consider that man an interloper who asks questions appertaining to the work.

Sagging, running and wrinkling are defects that are sometimes caused by poor mechanics who apply too much paint or enamel or who have no idea of thoroughly brushing out the paint. On the other hand I have seen severe cases of this trouble which were entirely due to the manufacturer. A paint will sag, run and wrinkle where the article in question contains an excess of oil or insufficient volatile matter. Another reason for the appearance of such defects may be the lack of a proper binder. In this case the paint becomes what is known as a "fugutive paint" if there is not something present to bind together the vehicles and pigment. When paint starts to contract or shrink the oil will desert the pigment and the entire surface will be covered with ugly sags and runs.

IMPROPER FOUNDATION IS DIRECTLY DUE TO POOR WORKMANSHIP

The prime coat is the foundation upon which the entire job is to be built. If the foundation is faulty the entire superstructure will topple over. The man who applies the prime coat should be as good a mechanic as

he who applies the finishing coat. This rule has been often neglected by foremen who trust the priming coat to helpers. The essential requisites of the prime coat are firm adhesion, impermeability and a uniformity of the layer of the thickness desired. These can only be obtained by a first-class mechanic who thoroughly understands the importance of brushing out his paint.

Nothing is more discouraging to the foreman painter than to find, after a job has been finished, that the surface is covered with minute and large blisters. This condition is far more common on cars finished with an oil enamel, which is used extensively in car painting today, than on cars painted by the older process. While it is true that in some cases blistering is due to an excess of oil or fat in the oil, in the majority of cases blistering can be justly attributed to painting over damp or moist surfaces. Blisters are more than mere blemishes on the paint film, they are serious defects which if allowed to persist will ultimately destroy the entire painted surface. In due time the blisters will



A SMOOTH DRY SURFACE IS ESSENTIAL IF BLISTER FORMATION IS TO BE PREVENTED

crack and allow water to get in under the paint film itself and thus destroy the under coats.

Where the job calls for the car to be scrubbed and enamelled, care should be taken to see that the surface is thoroughly dry before the enamel is applied. If the surface is damp or moist when the enamel is applied countless water molecules will spread over the surface under the thin enamel film. When the car leaves the shop the rays of the sun beating upon the surface of the car will draw these molecules of water together at a point where the structure of the paint film shows the least resistance.

While the paint is drying it is constantly taking on oxygen. The moisture, oxygen and oil, aided by the heat of the sun, tend to generate a gas under the film. This causes the expansion which we call blisters. Of course these factors do not absolve the paint manufacturer from all blame and it is all up to the foreman painted to fix responsibility.

Proper Mixing is Most Effectual

Too must stress cannot be placed upon the importance of proper mixing of the paint. Many a job has failed because the paint has not been properly mixed. Paint is composed of ground inorganic matter or the pigment, the organic or liquid matter with which we mix it, or the "vehicle", and volatile matter. The finer the pigment is ground the better the mixed paint will be because the greater the number of particles of pigment on the surface the better the protection the dried oil will receive.

In mixing the paint it is important that the oil be added to the paste and then paddled until every particle of pigment is incorporated in a close union with the oil. Under no circumstances should any tinting colors, driers or turpentine be added until this close incorporation has been effected. The paint should be mixed to a workable consistency so as not to bring about much muscular fatigue to the painter using it. The use of paint that is hard to work under the brush tempts the painter to thin it out. This has caused many paint jobs to fail, where the reason for the failure could never be traced.

Japan Driers Are Not Favored

Japan driers are carriers of oxygen. A paint that is supersaturated with oxygen loses its toughness and becomes brittle. Under no circumstances do I approve of using japan driers. Boiled oil, because of its peculiar manufacturing processes, possesses drying properties, and it was always intended as a vehicle to accelerate the drying of mixed paint, but not as a general paint vehicle. The foreman painter who does not recognize the true merit of boiled oil as a drier and insists upon destroying the neutral oil in the paint by adding japan driers is either incompetent or not on the level with the firm which is paying him wages. In either instance it is folly to retain him in a business where he will burn up good paint and waste money.

Turpentine, while making the paint more workable, should ever be used conservatively and should be added only in quantities sufficient to aid the paint to penetrate the under coats. It should never be used to thin out or extend the paint after it has been mixed. Up to the present time nothing has been found to equal linseed oil as a paint vehicle. While Tung oil or China wood oil is superior to linseed oil in resisting water, it has never made any marked impression as a general paint vehicle.

Care should be taken to see that the oil used is pure. Adulteration of oils is frequently the cause of failure of an expensive painting job. I have seen paints that possessed neither drying nor binding qualities because of the oil foots. Oil should be tested for its drying qualities. Any man who has been handling oils for any length of time can detect adulterated oil by smelling and tasting it. When placed in a test tube and held to the light a cloudiness and a heavy precipitation will give evidence of oil foots.

Boiled oil flowed on a piece of glass and placed in a vertical position in a room of about 70 deg. temperature, should dry free from tackiness in thirteen hours. A simple and fairly accurate test for pure turpentine is to place a drop on a sheet of white paper. Rapidity of evaporation without any pronounced greasy residue will prove the purity of the article.

Paints dry by absorbtion, oxidization and evaporation. In order to facilitate these the shop should be warm, well ventilated and free from dampness and obnoxious gases. Another important feature in painting is not to use any soap, cleaners or renovators which contain acids, ammonia, free lime or any other alkali. Careful cleaning and proper drying are necessary.

Overhead Practice and Experience in Atlanta

Iron Trolley Wire Used With Success on City Line—Special Construction Practices Which Have Materially Reduced Maintenance Costs



BACKBONE CONSTRUCTION ON CURVES AND CATENARY CONSTRUCTION OVER STRAIGHT TROLLEY IN FRONT OF ATLANTA CARHOUSE



CROSS CATENARY SUPPORT FOR OVERHEAD, ALONG FRONT OF CARHOUSE CAN BE SEEN IN THIS VIEW OF "PERMANENT" OVERHEAD CONSTRUCTION

FOR the past three and one-half years, T. F. Johnson, superintendent of transmission and distribution, Georgia Railway & Power Company, Atlanta, Ga., has been making a more and more extensive use of iron trolley wire until about 25 miles have been installed to date. As this company has had very satisfactory results from the use of iron wire on its city lines, its experience is enlightening.

The use of iron wire was originally tried in Atlanta as a means of reducing the rapid wear and consequent need for very frequent replacement of certain sections of the copper trolley. It was not gone into as a means of reducing the investment required or to get away from the use of copper for other reasons although the very high price of copper during the war, coupled with its scarcity, undoubtedly influenced a greater use of the iron wire than would naturally have followed without these unusual conditions.

There was a viaduct where the copper trolley wore out so rapidly that it had to be replaced every six months and it was at this point that the iron wire was first installed. This original wire has now been up three and one-half years and upon a recent inspection it was declared to have a remaining life of at least two and one-half years. The wire used on this first installation as in the later ones, was of No. 000 round section. In the catalog of the manufacturer, the John F. Roebling's Sons Company, it is loosely termed "iron wire", but in reality is a mild steel, or a steel having a very low carbon content. This wire is galvanized so that the rust will not fall down on the roof of the cars as they pass. The galvanized surface wears off quickly on the under side of the wire which becomes bright like a steel rail but remains on the top and sides of the wire to protect it from rusting.

The iron wire having demonstrated its adaptability for service on this initial installation, the Atlanta company began the practice of installing it on curves. At these locations copper trolley wears rough, whereas the iron wire becomes polished and smooth, seemingly indicating that the wear on trolley wheels is much less. The iron wire is also desirable at these locations because of its greater strength.

On straight line work the iron wire has been installed in Atlanta only in those locations where there was sufficient capacity in the feeder cable along that street to carry the full load without including any of the conductivity of the trolley itself. However, it was stated that on this basis iron wire could be used on 60 per cent of the whole Atlanta system with the present feeder installation. No wire has been installed, however, in the down-town section, except for that on the curves, because of the large number of cars which pull current from a short section of the wire at a time. It would take too much feeder copper to make the use of iron wire in this district possible, and furthermore the company does not have the poles to carry such feeder. The practice followed in the down-town section is to use ring feeders and to have also special work inside the ring of iron wire.

Iron wire is installed under a tension such that it is practically without sag in the winter and has a 3-in. sag in summer. Taps from the feeder to the trolley are cut in at every other span, using the ordinary feed-in ear for connecting to the trolley wire. One of the difficulties in connection with the use of iron wire has been that for some reason not fully determined the brass ears used with it burn off very rapidly—much more rapidly than with the copper trolley. To eliminate this defect, an effort has been made to secure iron ears. but a satisfactory design had not yet been secured at the time of this writing.

W. A. Wilder, general foreman of trolley work, states that the linemen like to work with the iron trol-

ley wire because it is much easier to handle than hard-drawn copper wire. When a break occurs in the iron trolley, the ends simply fall down but do not snap and fly as the hard-drawn copper does. For this reason, it is easier for the men to repair the break, an ordinary mechanical splicing ear being used. Also, if the iron wire touches the rail in falling, it burns off but does not anneal, so that all of the wire that is left intact can be used in making the repair and there is no waste.

In connection with trolley breaks it is interesting to point out that the annealing of copper trolley for considerable distances back of a break has led the Atlanta company to install an equalizing connection between the two trolleys at every fourth span over the entire system. It has been found that with these cross connections a trolley coming in contact with the rail will anneal back to the equalizer only. Apparently the combined conductivity of the two trolleys from this point gives sufficient current carrying capacity so that the heating does not reach the annealing temperature. These equalizer wires are made from old pieces of trolley and connected by means of Ohio Brass feed-in ears. It is claimed that their presence saves a great deal of trolley. The overhead system in Atlanta is not sectionalized.



BACKBONE REINFORCEMENT OF TROLLEY CURVE AT BUSY DOWNTOWN CORNER WHERE ABSENCE OF ANCHOR POLES BROUGHT BULL-RING CONSTRUCTION INTO USE

The only thing the line department has against the use of iron wire is that it has found that there seems to be a rather frequent splice in it as it is unreeled, and that frequently there will be a kink at the splice. If it is attempted to hammer out the kink the wire frequently will snap, seeming to be very brittle at that point. It is understood that in the process of manufacture it is necessary to have about forty-two such splices on a full reel holding about 4½ miles of wire. These splices are made by butt-welding and it is possible that the unfavorable experience of the Atlanta linemen resulted from these welding points being cooled too rapidly and thereby hardened. The manufacturing process is such that each splice is supposed to be thoroughly annealed to prevent brittleness at the splices.

PRACTICES DESIGNED TO REDUCE MAINTENANCE AND CAR DELAYS

The practice of backboning curves is not a new one but it has probably been carried further on the Atlanta property than in nearly any other city. For all curves in the entire system have been rebuilt in the manner illustrated in accompanying photographs. The result has been that the delay of a car on account of a break at a curve is practically unknown, for with the present construction if a break does occur, only a very short piece of the wire hangs down and the car can coast by the break without being delayed. Because of this assurance of not tying up the cars even if a break does occur, it is possible with the back-bone construction to leave the trolley up until it is completely worn out. In other words, early replacement of the wire does not have to be made as an insurance against breakage.

The messenger cable forming the backbone is put up to parallel the trolley all the way around the curve. If it is a double-track curve, both trolleys are backboned. But the backbone is not made in one continuous wire but is turned back and served up at each pull-off, so there is a short piece between adjacent guy wires. The backbone is separated from the trolley only by the hanger arm and wood strain insulator. At each end of the backbone, the guy wire is made to pull off as nearly tangent to the curve as is possible, considering the possible locations of a pole or other anchor. With this backbone construction the pull-off guys are so arranged that should any one of them become detached from the trolley, it will not hang down far enough to obstruct the street.

One place where this backbone type of construction has proved to be particularly effective is at the carhouse. Here there are twenty-seven tracks entering the building, seventeen turning in one direction and ten in the other, with an overhead trolley over each one. Before the present overhead construction was installed it was an unusual day that the line crew was not called to the carhouse to repair the overhead. The present construction, which is quite clearly pictured in two accompanying halftones, has now been up two years during which time the line crew has been called to the car house very rarely.

All of the trolleys turning into the car house are of iron wire while the wire over the straight track along the street in front of the building and that inside the barn is copper. A circuit breaker was placed in each bay of the car house to localize any short circuit disturbance.

The straight wire along the street is supported by a long catenary messenger cable which is attached to each trolley switch by means of a wood strain insulator and a piece of trolley wire looped through the two side eyes of the switch and the eye of the insulator. Another catenary messenger cable was strung parallel to the front of the car house and about 15 ft. in front of it. It was installed to provide an additional support for the twenty-seven trolleys as they straighten to enter the carhouse. This catenary was fastened between trolley wires to the span wire by means of a hanger and three-bolt clamp and clevis.

Each curve is backboned and switch guys and backbone guys are installed for each curve. Thus very large number of guy wires was distributed among seventeen anchor poles placed along the street. The backbone tangent guys were fastened to a pole at one end and to the building at the other end. In the latter case, a bolt and nut in the top frame of the Kinnear doors which

held the latter to the steel column was removed and a bolt with a female eye head used instead, thus serving the double purpose of bolting the Kinnear frame and as an anchor for the guy. A No. 504 O.B. porcelain strain insulator was inserted in these guys as a double safeguard against grounding, the woodstrain insulator between the trolley and the backbone cable providing the ordinary insulation.

NOVEL INSTALLATION OF TROLLEY PROTECTORS

In using trolley protectors in 5-ft. and 6-ft. lengths at the approach to switches it was found that the trolley wire wore out very rapidly just in front of the first end of the protector. After some experimenting it was found that if about 6 in. of the first end of the protector were cut off and this section inverted so that it was placed on top of the wire instead of underneath, the wear at this point was practically eliminated. Placing a short piece of protector in this position apparently makes an approach to the section of the protector placed in the usual position such that there is no bump to cause any arcing.

The Atlanta company saved $2,700 for the first ten months of 1919 by handling overhead junk material in a manner to realize the greatest junk value. For example, the trolley ears turned in for junk are sent to the repair shop where one man continuously employed on this work separates the copper wire from the brass ears and removes the iron set screws. If the ears were sold as they come in, without separating the different metals, they would bring the scrap value of the lowest valued metal, or about 10 cents a pound. By separating them, the copper can be sold for say 18½ cents a pound, the brass for 10 cents or 12 cents. Further, if in reclaiming these metals, the workman finds a dozen good ears in a day which may be saved with a little repair work, it means a saving of twelve times $1.25 or $15. In handling this work, the storekeeper charges out 1,000 lb. of scrap at 10 cents a pound to this workman, who makes his returns to the store room in about these proportions: 500 lb. of scrap brass, 400 lb. of copper, 100 lb. of good ears. The workman's time is charged to the work order on which the reclamation work is done, the net saving totaling up a surprisingly large profit as indicated from the figures given above.

Remote-Control Sectionalizing Switch

A Saving of More than $400 per Month Resulted from the Installation of This Simple and Inexpensive Device

BY H. P. BELL
Electrical Engineer San Francisco-Oakland Terminal Railways, Oakland, Cal.

THE San Francisco-Oakland Terminal Railways have recently installed a novel economy in substation operation and insurance for continuity of power service in its Richmond substation. The installation as shown in the wiring diagram is an adaption of an automatic sectionalizing switch with the GE-DB-276 contactor remodeled to take care of the special conditions encountered in this case.

The limiting conditions calling for this particular installation were as follows: On account of power contract relations it was necessary and desirable to serve power to the cars of this division entirely through the conversion apparatus at Richmond substation during the time when there was any appreciable load in this district. Incidentally, Richmond substation is fed on the alternating-current side under contract from one of the larger power company's 11,000-volt lines from hydro-electric sources. Although it was desirable to shut down this substation between the hours of 1:30 a. m. and 5:30 a. m. in order to eliminate the no-load losses in the plant and the cost of the station attendance, it was necessary to keep the district-current lines "hot" to provide for moving, repairing and testing on cars in the yard and carhouse, and also to take care of the necessary street and crossing lights. It was also true that the alternating-current source of power for the district just south of the section insulator which separated that district from the Richmond district was much more reliable than the alternating-current power to Richmond substation. Therefore, from all angles of economy and continuity of service it was desirable to have a connection with another 600-volt direct-current source of power which could be operated at will from the switchboard of Richmond substation, and which would also provide protection from shorts and overloads as between the two sections.

The only source of 600-volt direct-current power reasonably available other than from Richmond substation was located 4.2 miles from that station.

After looking over the available apparatus on the market which could be installed at a reasonable cost and which would come anywhere near performing the desired functions, it was decided to remodel and adapt a General Electric automatic sectionalizing switch for our use. The relay of this switch in its standard commercial form is provided with two coils, one shunt and one series, operating a contact which is closed in the normal "down" position. This contact is in the contactor operating-coil circuit. An excessive flow of current through the series coil from one section to another will open the relay contact and drop out the contactor. The shunt coil, being connected across the two sections, will hold the relay contact open so long as there is sufficient difference of potential between the two sections. It can be seen from a study of our requirements that the relay shunt coil was not a desirable feature, in fact its use would rob us of manual control of the contactor. The coil was therefore eliminated. The negative side of the contactor operating coil was carried over an iron wire line to the substation switchboard. The negative side control was used to eliminate the expense of a two-wire line which would have been necessary for the positive side control. Iron wire was used for economy both in the line and as a substitute for other resistance.

The switchboard installation at the substation as shown in the wiring diagram consists of a knife switch F, an indicating lamp G, a 600-volt push-button switch K and a relay H-J, operated on three parallel circuits which contain the necessary fuses and resistances. Upon the closing of the knife switch F, an indication is received through the indicating lamp G, as to whether or not there is power on the 600-volt direct-

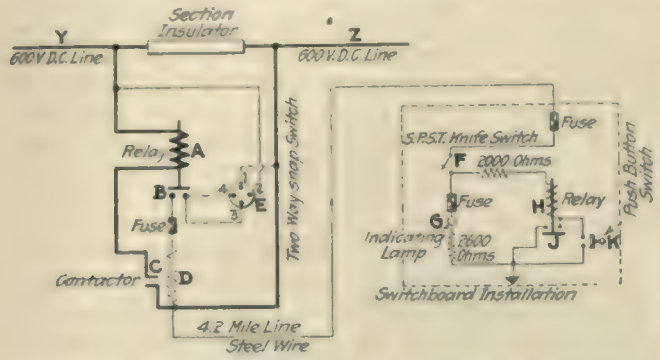


DIAGRAM OF CONNECTIONS FOR REMOTE-CONTROL OPERATING SWITCH

current lines in the section Z, into which it is proposed to tie. Then when it is desired to tie into this section Z, the push button switch K is closed energizing the coil H of the switchboard relay which closes the contact J, completing the control circuit to ground, and energizes the contactor-closing coil D, thus tying the two 600-volt systems Y and Z together.

WHAT HAPPENS WHEN A "SHORT" OCCURS

If a short should occur on the Richmond 600-volt system Y, an excessive flow of current would energize the series coil A of the switch relay and open the control circuit contact B, which would allow the contactor C to drop open, separating the systems. The opening of the control circuit at B would also de-energize the switchboard relay coil H, opening its contact J so that the systems would not automatically tie themselves together again as soon as the contactor C opened and interrupted the rush of current through the series relay coil A at the switch. The circuit would remain open until the night foreman of the carhouse, upon entering the station, could determine where the trouble was by observing the indicating light and trying the push-button switch once to see if the systems again separated after being closed. If they again separated the emergency lineman would be called as usual to clear up the grounded line.

A two-way snap switch E is cut into the positive side of the control line to provide for reversing the control in case it is ever desired during emergencies to provide power on section Y and at the same time feed into section Z.

This installation has been in service for about six months, has proven entirely satisfactory, and has developed no failures whatever. The only maintenance required has been a monthly inspection and cleaning of contacts. It has yielded a saving of $412 per month, and the longest power interruption in the 600-volt direct-current service to this district since the installation has been four minutes, although we have had several severe interruptions in the alternating-current service to the substation of from sixteen to fifty-seven minutes' duration.

Coal Heaters Electrically Equipped for Intermittent Use in Spring and Fall

THE Sioux City Service Company is installing on each of its cars Peter Smith forced ventilation hot-air heaters equipped with four electric heating coils. The object is to provide this ready means of securing the small amount of heat needed only for an hour or two at a time during the fall and spring months.

The electric heater coil equipment is very simply incorporated into the coal heating system by installing four 500-watt coils, one in each corner of the outer steel casing of the stove, between the outer and inner casings. The cold air taken in through the floor of the car is drawn up over the four heater coils by the blower and forced down through the inner casing into the distributing duct along the side of the car.

The four coils are permanently mounted in a vertical position and are so connected electrically that current cannot be turned on through them until after the blower switch has been closed. This circuit is used to prevent any possibility of burning out the inner casings or coils if there were no circulation of air. During the winter months when the coal heat is required, the fuse in the circuit of the four heater coils is removed so that they cannot be used. The wiring diagram taking care of these two provisions is illustrated in an accompanying drawing.

It is claimed that this auxiliary electrical equipment in the coal heater system overcomes an objection which

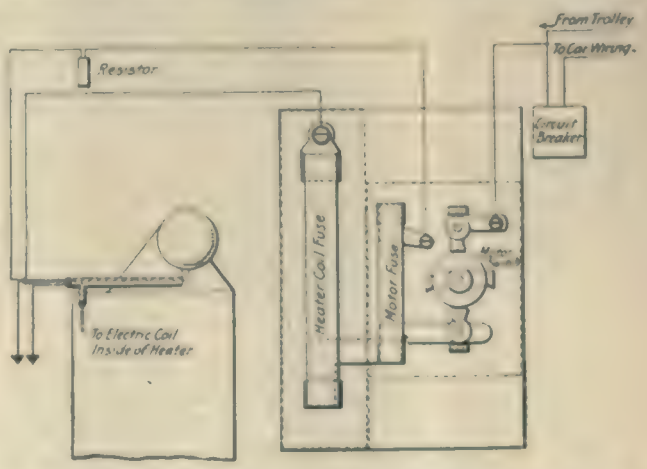


DIAGRAM OF CONNECTIONS FOR COMBINATION ELECTRIC AND COAL CAR HEATING SYSTEM

some railway men have expressed, that it made the cars too warm at times in the fall and spring; or that it was necessary to build a fire which would last for many hours in order to supply heat needed for perhaps only an hour. The additional cost of the system with the four electric coils incorporated is small.

Car conductors have a habit of leaning against the coin box supports. The backs of their coats wear out at the point of contact with the support. New coats cost money nowadays, so any device that will save them from wear will be appreciated by trolleymen. An inventive genius has solved the problem. A reinforcing strap of leather, leather substitute or heavy rubberized fabric about three or four inches wide is sewed all the way across the back of the coat at the point where it rubs against the support.

Rehabilitating an Overhauling Shop

By Utilizing the Space Formerly Occupied by Carpenter and Blacksmith Shops, the New York State Railways, Utica Lines, Was Able to Increase Their Facilities for Overhauling Equipment and Rebuilding Cars

BY H. S. SWEET,
Master Mechanic New York State Railways, Utica Lines

THE Utica Park shops of the New York State Railways take care of the car equipment necessary for operating the Utica, Rome and Mohawk city lines, as well as an interurban line which runs from Rome to Little Falls. The growing business of the company and facilities required for carrying out a car rebuilding program which had been undertaken by the company made it necessary recently to obtain increased space, as the previous arrangement of the shops so limited their capacity that this additional work could not be taken care of properly.

The principal point of congestion was in the overhauling shop. With the old layout it was possible to hoist but three cars at a time, and as all of the wheel and armature changes for both the city and interurban lines were taken care of here, this overhauling shop was necessarily very greatly overloaded. During the winter months, when car repairs reached their maximum, it was almost impossible to take care of the equipment.





AT LEFT, NEWLY ARRANGED CARPENTER SHOP. AT RIGHT, TRUCK SHOP

SLIGHT CHANGES ALMOST DOUBLE OVERHAULING CAPACITY

A drawing on page 568 shows the layout of the shop, both before and after the changes were made. The carpenter shop, which was formerly located in the rear of the truck shop, was removed to an adjacent carhouse which was formerly used for storage purposes, and an annex, 45 ft. long x 12 ft. wide, was built at the center of the overhauling shop for use as a blacksmith shop. This was the only additional building necessary and the location of the blacksmith shop opposite the truck overhauling section provided a very convenient location for carrying on the work. The carpenter shop was located close by. By these changes the capacity for overhauling was practically doubled.

By referring to the former layout of the shop it will be seen that at the side of the carpenter and truck shops, which occupy the central part of the building, were located the electrical department and armature room, a mill room, a blacksmith shop, a machine shop, a store room and the main office. In the layout as rearranged the armature room was left in its old location, but the controller and resistance work formerly taken care of at a bench in the rear of the armature room was moved to a balcony built in the rear of the room. This gave increased space of approximately 17 ft. x 15 ft. A commutator slotting saw of General Electric make was installed in the armature room to take care of this work which was previously done on a planer.

The location of the machine shop was changed from a point just in the rear of the store room to the space previously occupied as a mill room. All of the machines except a wheel press and boring mill were removed into this space; then, by rearranging the wheel press and boring mill, additional room was provided for motor overhauling. A hoist for handling the work conveniently, and a number of benches were installed in what was formerly the machine shop.

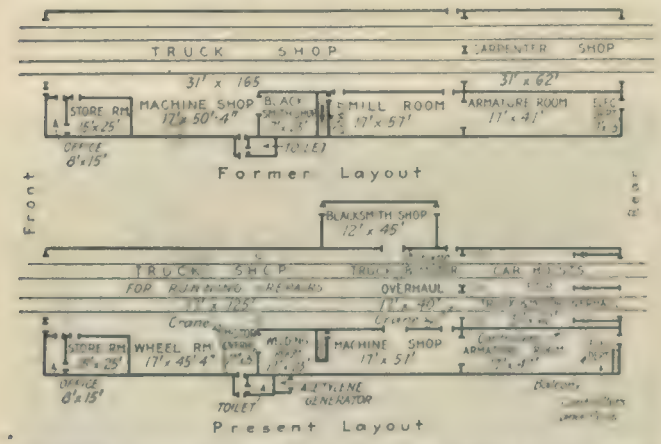
The space previously used as a blacksmith shop was fitted up as a welding room and an acetlyene generator was installed just outside this room. This location right back of the space used for motor overhauling and adjacent to the truck overhauling part of the shop was chosen as being most convenient.

In the rear of the truck shop where the carpenter shop was formerly located, car hoists were installed for use in overhauling. Cranes were set up in front of these in such a location that they would swing from each side to do the work necessary in overhauling the trucks. One of three hoists which was formerly used for wheels and armature work was also made available for overhauling by the equipping of two carhouses with

the facilities necessary to enable them to change their own wheels and armatures. This diminished the work of this class which it was necessary to take care of at the Utica Park shops.

In the previous arrangement the hoists used for the wheel and armature work were on travelers running on beams hung below the trolley wire. This arrangement was very unsatisfactory as it necessitated the pulling off of trolleys whenever cars were moved around the truck shop. This location also resulted in many minor accidents. In the rearrangement the hoists were raised so as to run on beams above the trolley wire which was arranged with narrow gaps so that the trolley wheels could run over without making it necessary to remove the trolley from the wire. This gap allowed a thin iron plate from which the hoist hangs to be installed.

As will be seen from the revised layout the truck and motor overhauling is done now in the center of the shop, the car hoists used in this work are located in the rear formerly occupied by the carpenter shop and the



PRESENT AND FORMER LAYOUTS OF UTICA PARK OVERHAULING SHOPS, NEW YORK STATE RAILWAYS UTICA LINES

front part of the shop is used for running repairs. By having the truck and motor overhauling done in the center of the shop, the necessity for turning cars when but one end requires raising is avoided and as the overhauling tracks run entirely through the shop the work can be arranged so as to be carried out without interference.

Two additional illustrations show views of the truck shop and carpenter shop so rearranged. The carpenter shop and mill room are now located in front of the paint shop which takes up a space of 195 ft. in the rear of a 500-ft. carhouse. In this rearrangement, all that was necessary was to put up a partition near the end of the carhouse, lay floors and install heating and lighting fixtures. The paint shop, which has a capacity of ten cars, was not enlarged as it was considered ample to handle the present work.

The shop changes and additions have enabled the company to carry out its extensive motor and truck overhauling program which would have been impossible under the old arrangement, and this thorough overhauling of the electric equipment has proved of great value during the severe winter months through which the company has just passed. The shop changes and additions described were carried out under the writer's supervision together with advice and help from J. F. Uffert, superintendent of equipment of the New York State Railways.

Old Tie Rods Made Over Practically Without Waste

TIE RODS saved from old track have accumulated rapidly in the yards of the United Railroads of San Francisco and an effort was made to find the best plan for making them again fit for service. As piled up in the storage many of the rods were badly bent, and practically all of them were deeply pitted by rust or electrolysis. The threaded ends were unfit for further use. A glance at the pile strongly suggested the scrap heap. The rods are being made over, however, so that they will serve their purpose practically as well as when new.

The first operation is to cut off the threaded ends, making one of these cuts an angular or scarf cut so that the end has only to be heated to be ready for welding. The rods are then straightened and piled up beside a preheating furnace. After preheating they are passed into an adjacent furnace where they are brought up to welding heat. Beside this furnace stands a power hammer into which special dies for welding rods can be fitted. The actual welding is done so quickly that a blacksmith and one helper handle the rods through the two furnaces and complete the weld at an average rate of one rod per minute. In fact, this rate can be maintained throughout the working day. After thus being extended to suitable length, the rods are re-threaded and fitted with new nuts. In this condition they are as easily handled and are thought to have almost the same life as new rods.

Reinforced Concrete in Railway Work

IN THE *Bulletin* of the *International Railway Association*, Vol. 1, p. 207, is an elaborate "note" on the use of reinforced concrete in England for railway work other than bridges and buildings, by L. Weisenbruch, chief engineer and administration manager in charge of railway signaling of the Belgian State Railways. In view of the comprehensive plans for electrification of the railway lines of Belgium, this paper is of unusual interest. The author covers the use of concrete for signal masts and telegraph poles, posts and ties.

He concludes that owing to the increasing scarcity of wood, and the present high prices of wood and steel, reinforced concrete can be economically applied at once on railways for signal masts and telegraph poles, fencing, supports for pulleys, etc., and ties for sidings and inspection pits.

Among suggestions regarding concrete ties he says that the best fastenings for securing the rails to the concrete ties are bolts going right through the latter. It seems advisable to interpose between the rails and the ties, in addition to a layer of bituminized card, a sole plate made of compressed maple 1 in. thick. The length of the tie should be as nearly as possible that of a wooden tie. It must be packed firmly under about 36 in. at each end, leaving in the middle an unpacked space of about 24 in. to prevent the formation of cracks. Hollow ties have, besides the advantage of lightness, that of having a large seat for a given weight.

All track joints are being double bonded by the Birmingham Railway, Light & Power Company as a means of making doubly certain of the continuity of the track return circuit. A 4-0 pressed terminal bond is placed under the fishplate and an Elrico bond on the head of the rail.

Track Construction From the Paving Maintenance Standpoint

The Birmingham Railway Has Tried a Number of Types of Track Construction in an Effort to Reduce the Surface Maintenance Expense—Its Experiences Are Related in the Following Paragraphs

THE maintenance-of-way engineer's work on a street railway property is devoted in no small part to the problem of devising a type of track and paving which will minimize the expenditures necessary for the surface maintenance. Along this line of endeavor, L. L. Newman, vice-president and chief engineer Birmingham (Ala.) Railway, Light & Power Company, has experimented with a variety of types of construction and thus obtained valuable information as to the merits and weaknesses likely to be found.

The most satisfactory service in Birmingham has probably been obtained with a rigid concrete substructure and a vitrified brick paving, wherein the paving between rails is so crowned that the bricks adjacent to the rails fit in underneath the heads of the T-rails, avoiding the use of any nose blocks. This construction is shown in an accompanying drawing. The substructure is made with 1-3-6 slag concrete which is carried from a distance of 6 in. below the wood ties up over the base of the rails to the paving level, less 1 in. A form board of the proper contour is used to smooth off the concrete between the rails and to provide the proper foundation contour for the brick surface. The bricks are laid on a 1-in. cushion of sand and the space between bricks and that along the rails is grouted in. The level of the paving is brought up even with the rail heads on the outside.

It has been found that this manner of paving to form



TYPES OF TRACK CONSTRUCTION USED IN BIRMINGHAM

No. 1—One row of bricks adjacent to each rail is laid crosswise while those between are laid longitudinally.

No. 2—All bricks between rails are here laid longitudinally. The rows can be carried around the curves in the same manner without complication.

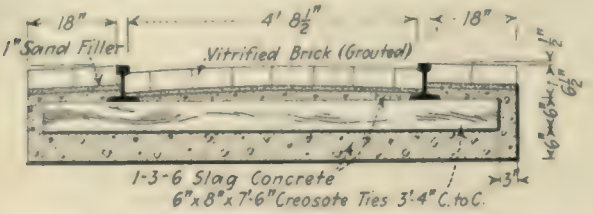
No. 3—Earlier concrete paving showing deterioration at the formed flangeway and at the expansion joints; also note the groove worn in at the joint between company and city paving.

No. 4—Concrete crowned underneath the rail head. Some deflections in the flangeway can be seen and also the noticeable joint between city and company paving.

No. 5—Monolithic construction without expansion joints and poured only between the outside rails, leaving the 18-in. outside for simultaneous pouring with city paving to avoid bad joints.

the flangeways has resulted in a much slower deterioration of the brick adjacent to the rails than was experienced with special nose blocks (other than Belgian blocks which are considered too expensive in this locality) which chip off badly. It will be noted that the substructure of this track is a monolithic slab of concrete, poured complete in one operation.

Two or three plans of laying the bricks in the above construction have been tried. The majority were laid with the length of the bricks across the track and staggered in the usual manner. On another stretch the row of bricks adjacent to the rails was laid crosswise of



SECTION THROUGH CONCRETE TRACK WITH BRICK SURFACE WHICH HAS GIVEN EXCELLENT SERVICE IN BIRMINGHAM

the track, while the bricks between were laid longitudinally. On still another stretch, all of the bricks were laid longitudinally between rails. The latter two plans have the advantage that the bricks can be laid much faster and with much less labor, since they do not have to be broken except at the starting point. The pavers can continue the brick right along on straightaway and on curves without any fitting. It was thought that with the bricks laid longitudinally, that is, parallel with the directions of travel, grooves would be likely to develop between rows, but this has not occurred after two years' use. These latter two schemes of laying the bricks are shown in two accompanying photographs.

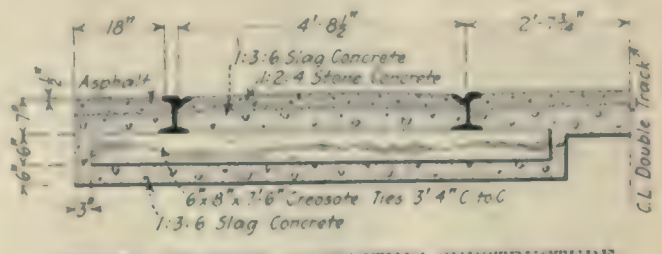
Experience with Concrete Paving

A number of different construction plans have been followed in Birmingham looking toward the development of a concrete substructure and paving which would give a satisfactory service, but while considerable improvement has been realized, a structure has not yet been produced which has overcome the tendency to crack. In the later construction work of this type of track and paving construction, the substructure concrete and the paving slab have been poured practically at the same time as a means of securing a monolithic construction. This avoids the seam between layers where the paving slab is poured separately after the substructure has hardened. The two-slab construction has shown a greater tendency to crack and it seems to be more noisy. The monolithic construction, on the other hand, tends to expand and contract as a unit, and there seems to be less likelihood of trouble from the seasonal temperature changes.

This monolithic type of construction, which is illustrated in an accompanying drawing, is poured in the following manner: The excavation is made to a depth of 6 in. below the ties, which for a 7-in. rail means a depth of 19 in. The ties are then laid and the rails spiked to them to gage. The structure is then brought to grade and alignment by using double wedges made from 4-in. x 6-in. rectangular blocks sawed in two diagonally. These wedges are 18 in. long and are placed directly on the ground if this is hard, otherwise on boards. The concrete mixer is then put onto this track and arranged to pour behind itself. It is first moved forward a distance of from 50 to 100 ft. and a course of 1-3-6 mix poured up to well over the base of the rail. The mixer is then moved back and the 1-2-4 paving mix poured up to the surface level. This makes the pouring of the two courses not over an hour apart, so that the entire structure sets as a monolith. Where the pouring is stopped at the end of a day, the concrete is permitted to run off in a natural taper. The next day the new mix is poured in over the taper, forming a kind of beveled joint, the presence of which cannot be detected in the finished work.

When girder groove rail is used the level of the paving slab is brought up even with the rail top on both sides. With T-rail, however, the paving surface is crowned down to below the rail head, rather than to form a flangeway in the concrete adjacent to the rails. Formed flangeways were used on some of the earlier concrete paving, but it was found that it chipped off very badly and gave an unsightly appearance after being subjected to traffic for a time.

The crowning of the concrete between rails down to below the head has not been altogether satisfactory, either, though an improvement. Under the punishment of truck and wagon wheels, the concrete along the flangeway has been found to break down to a certain extent, probably due to imperfections in getting the mix thoroughly tamped in under the head of the rail and against the web. This breaking down can be seen in an accompanying photograph which also shows another objectionable feature of concrete paving which has been eliminated in the most recent construction of the Birmingham company, namely, the seam or joint between the paving built by the railway company and that built by the city. In this latest construction, which is also illustrated herewith, the street railway company poured its paving slab only in the area between the outside rails of the two tracks. Paving of the 18-in. strip which the company is compelled to install outside of the rails was deferred until such time as it could be poured simultaneously with the city's paving, thus eliminating the joint. The picture shows the company's paving prior to the installation of the city's portion outside the



SECTION THROUGH MONOLITHIC SUBSTRUCTURE AND PAVING

rails. The street was left in this condition for about a year, and while the outer rail had no lateral support on one side, the concrete inside the rail did not seem to be deteriorated under traffic, as a result.

The city has always forced the company, previous to the time of this last construction, to build its 18 in. of pavement outside the rails in advance of the city's work. This has invariably resulted in the wearing of a bad groove at the joint, and so the city's engineers have finally been prevailed upon to permit the pouring of the entire area outside the rails at one time, thus avoiding the joint altogether.

On the first installations of concrete track and paving construction, where there was a seam between the substructure and paving slabs, an expansion joint was put in every 16 ft. Despite this precaution, cross cracks developed and the expansion joints wore low and made unpleasant, regularly spaced bumps in the paving. On subsequent pieces of construction the expansion joints were put in 33 ft. apart, then 50 ft., then 100 ft., and finally eliminated altogether. On some of the monolithic types of construction built without any expansion joints, and which have now been down for two years and over, no defects have developed which could be attributed to their absence. About two miles of this type of construction is in use.

The cross cracks continue to make their appearance after the track has been in use a comparatively short time, despite all efforts to overcome this defect. They often develop into bad holes under heavy traffic and require patching. Regardless of the distance between expansion joints, in the earlier constructions, one or two cracks would develop between joints in almost every section. In the latest type with the expansion joints eliminated, the cracks have also developed, in some places, with a noticeable regularity. However, these cracks are often very small and do not wear to any extent for long periods of service, so that the maintenance expense is fairly low and the life of the paving quite long.

Repairs to Car Seats and Curtains

A Summary of the Work Being Done and the Apparatus Used by Several Electric Railways in the Maintenance of These Simple but Important Furnishings



THE CURTAIN REPAIR DEPARTMENT IS A BUSY PLACE

SPEED, safety and comfort are looked upon as the three chief fundamentals in electric railway transportation and the repair of seats and curtains forms a considerable part of the work necessary to keep cars in attractive and comfortable condition for the traveling public. The following summary of the maintenance practice of several electric railways has been arranged in order to give those interested as much information as possible regarding their several practices in this work.

The practice followed by the Detroit United Railway in connection with the maintenance of cane or rattan-covered seats is to shellac and varnish with two coats all new seats before placing them in service. The shellac is put on with a brush while the varnish is sprayed on. After the cane becomes dirty from use the seats are scrubbed with soap and water and then cleaned or bleached with a solution of oxalic acid which removes the varnish and dirt with it.

This solution of oxalic acid is made by dissolving 1 lb. of crystals in 5 gal. of water. Both are placed in a 5-gal. crock and boiled by means of an electric heater dropped into the crock, until all crystals have gone into solution. After the solution has been painted on a seat and allowed to remain for about one-half hour the rattan is wiped dry with rags and the seat is painted with a coat of straw-colored cane enamel.

About once a year thereafter the cushions are washed with linseed-oil soap and water and if the enamel is in bad shape the cushions are painted with a new coat of enamel. Before the re-enameling, any small holes are repaired by weaving in new cane. In washing the seats, a stiff hair brush is used.

Plush Seat Renewal

Plush-covered seats used by the Detroit United Railway in interurban service are cleaned with vacuum cleaners frequently by the regular car cleaners. About once a year, when the car is shopped for painting, the seats are renewed, if not in bad shape, simply by cleaning with gasoline. If the plush is faded, use is made of the Wilson Paint Company's cleaning and renovating preparations. One of these preparations draws the color slightly and the other fixes it. These solutions can be used, of course, only on solid-colored seats. If the plush is worn, new sections are put on if the seats are sectionalized, otherwise a whole new cover is necessary. This is done by hand work and three upholsterers are

able to do all of the rattan and plush seat repair work for the entire system. The painting and cleaning of the rattan seats requires practically the entire time of two painters.

Hugh Savage, general foreman of the Detroit United Railway shops, states that the renewal or reclamation of the pantasote curtains used entirely by the company has been very unsatisfactory. He has had them washed with soap and water and cleaned with gasoline, and has tried various other methods but has found none of them of much avail in renewing the faded fabric. Water and dust stains can be washed out, but if the colors have run or the curtain is faded, practically nothing can be done. Some curtains were sent to a Detroit shade-cleaning company as an experiment, but the curtains came back stiff and not clean, and the job was considered generally unsatisfactory. The practice of washing the curtains with soap and water about once a year is now followed. As they become faded they are taken off and the rolls and ends are changed. By this means a life of seven or eight years is secured.



SEAT SCRUBBING MACHINE

A hand press which makes the work of putting on new rattan covers on car seats a much easier task and a better job, has been devised by William H. Sanders, employed in the carpenter shop of the Newport News & Hampton Railway Company. This press consists of a 24-in. x 40-in. frame into which the rattan and then the seat cushion are placed, and above which are two yokes providing a clearance of about 12 in. Five ¾-in. jackscrews, two at the front side of the frame, two on the top and one at the end, are then screwed down against 4-in. x 4-in. timbers placed on the top, end and side of the cushion which lies in the frame, bottom side up. As these three screws are tightened, the rattan is pulled tight and finally is tacked over the bottom of the cushion frame. With the help of this hand press a seat can be covered easily by one man in forty-five minutes or less, it is done without injuring the hands and the rattan is evenly and securely fastened.

In the two accompanying photographs the seat cushion is wrongly shown with the cane side up. In actually using the press, the cushion is put in bottom side up and forced down against the rattan sheet.

Chicago Elevated and North Shore Line Practices

In cleaning and reclaiming rattan-covered seats the Chicago Elevated Railways are making use of one of the Wilson Paint Company's rotary brush scrubbing machines and the bleacher or varnish remover solution which that company supplies for this purpose. Water and a small amount of the bleaching liquid are forced through the brush from the inside of the cylinder. This process has proved very effective in removing the dirt. If the cane is blackened, a coat of Wilson cane enamel or varnish is painted over the cushion. This process brings out the natural cane color and makes a very satisfactory job.

The above practice is used only when the cars are shopped for painting, the ordinary cleaning being done simply with soap and water.

For cleaning the plush seats used mostly on the Chicago, North Shore & Milwaukee Railroad, just soap and water and a drying process have been used thus far. In speaking of this, H. A. Johnson, superintendent of equipment, said that it would probably be necessary soon to make use of a good dye to restore the color on some of the most faded cushions.

Like the Detroit United Railway, the Chicago Elevated lines and North Shore line have not found any satisfactory means of reclaiming the fabric on one side of the pantasote curtains. For this reason all curtains purchased during the last year or two have been specified to have the pantasote on both sides.

At the South Side shops of the Chicago Surface lines, whenever a car is shopped for a complete overhauling, the seats are put through a cleaning and renewal process. They are first taken to a cleaning tank and there thoroughly scrubbed by hand with a special bristle scrub brush, making use of a soap-and-water solution to which has been added a preparation of much the same character as "Gold Dust" or "Dutch Cleanser." This scrubbing is continued until all dirt is removed, no bleacher being used. The cushions are then rinsed off, dried and given a coat of varnish. No enamel is used on the seats at all. When they are new, they are given two coats of half body and half finish varnish.

In connection with car curtain maintenance, the experience of the Chicago Surface lines has been much like that of the Detroit United Railway. Nothing has been found which is effective in brightening the fabric on pantasote curtains when it becomes faded. The Chicago company cleans the curtains by thoroughly washing them with a brush and soap and water, and the pantasote side is coated with pantasote glaze which renews its finish. After four or five years' service, the curtain is reversed on the roller, bringing the unfaded top into the exposed lower position and thus improving the appearance.

No Varnish or Enamel Used

The practice followed at the West Side shops of the Chicago Surface lines is simple and yet the results obtained seem to be very effective. The seat cushions and backs are merely washed with a rather strong solution of laundry soap and water, making use of a rather stiff brush and sponging the soap off and rinsing the cushions thoroughly, though drying promptly so that the canvas backing does not get wet. No oxalic acid or other bleaching fluid is made use of. One point in which the seat maintenance practice of these shops differs from that of most roads is that a great majority of the seats have never been varnished or enameled at all, not even when the seats were first put into use, except for what little varnishing may have been put

on by the manufacturer. Dependence is placed simply on the natural luster of the cane. Some of the newer rattan which is coming through from the manufacturer recently seems to be drier, softer and whiter than the rattan received on seats heretofore. On this a coat of rattan varnish is sometimes put to protect the surface, but after this first coat no further varnishing is done after the periodical cleaning process.

In cleaning the curtains, use is made of soap and water only, on both sides. Sometimes a little neatsfoot oil is used on the pantasote side to remove any stain and soften the material. No satisfactory process of brightening the fabric after it has become faded has been found.

In Brooklyn the work necessary for keeping seats and curtains in repair is centralized at two of the principal shops. All curtain repairs are taken care of in the curtain department of the 39th Street repair



RATTAN SEAT COVER PRESS, SHOWING THE FIVE JACK SCREWS



RATTAN COVER STRETCHED TIGHTLY OVER THE SEAT IN THE PRESS

shop and seat maintenance is done at the Eastern Division elevated shop. Modifications and improvements have been made in the older type of seats to overcome minor difficulties and troubles in operation. A particular source of trouble was that nails would gradually work their way up and eventually penetrate the rattan and project so as to tear the clothing of passengers. Another source of annoyance was the breakage of the steel springs. To overcome these difficulties strips are riveted to the spiral springs and are carried only to within one-half inch to one inch of the side frame. The edges of these strips are bent back by a special machine so that there is no possibility of the sharp edges cutting through the seating. A strip of canvas is riveted over each spring steel strip and this canvas is glued to the framework and carried around and nailed to the bottom of each side piece. The locating of the nails in the bottom of the framework prevents their working out and doing damage. When the seat is ready for its covering of rattan it is placed in a press with a bed of proper size. One end and one side of this bed frame are adjustable and are operated by means of a pair of screws. The seat covered with loose rattan is placed upside down in the bed and the screws are applied while the seat springs are compressed from above by hinged levers, which press against a cross-bar placed over the seat slats. The entire seat is thus placed under compression which permits the rattan to be properly tightened for nailing.

The curtain department not only takes care of the repairs to car curtains but also makes other canvas and leather articles which are used on the railway system, such as money bags, mail bags, hand bags, fire extinguisher straps, hand straps, canvas aprons for snow sweepers and the like. The work of manufacture and repair of curtains done in this department has been so successful that the company no longer buys complete curtains except where they form an integral part of a bid for new cars. In addition to the repairs necessary to the damaged parts of the curtains a systematic cleaning and painting is also carried on. Previously it was the custom to use two coats of paint to secure a glossy finish but it has been found possible now to obtain the same result with one coat by adding a thin solution of Japan drier. The freshly painted curtains are hung on rollers and are permitted to dry for ten hours. An important feature in connection with this curtain department is the scrap collecting and handling. All inspection and maintenance shops are required to send all discarded curtain material or damaged curtains, no matter what their condition may be, to this shop. In this way it is possible to reclaim many springs, rollers, screws, pieces of curtain cloth, etc.

The Auburn & Syracuse Electric Railroad cleans its curtains thoroughly and washes all water stains out with soap and water. The curtains are then drawn through a vat containing 12½ lb. of paint of any color desired in oil, ¾ gal. of turpentine, 1 pint of Japan drier, 1 lb. drop black in oil and ¾ gal. of raw linseed oil. After the curtains are thoroughly saturated they are allowed to drain for about two minutes and are then laid over a bench and brushed thoroughly while the fabric is still wet. This operation raises the nap of the cloth and prevents the linseed oil from leaving the cloth stiff. After brushing, the curtain is hung up with the roller end down for stretching and is allowed to dry for twenty-four hours. The cost of this process is about 18 cents per curtain. Curtains made up of leather on one side and fabric on the other are not dipped, but the paint is brushed into the fabric while it is laid flat on a bench.

In the shops of the Beaver Valley Traction Company, New Brighton, Pa., the following formula is used as a mixture for cleaning the seats in the shop. Aqua ammonia, 2 oz.; soft water, 1 quart; saltpeter, 1 large teaspoonful; Ivory soap, shaved, 1 oz. The soap is thoroughly dissolved in hot water and then the saltpeter and ammonia are mixed in. This is applied with the ordinary scrubbing brush, after which the seats are scrubbed with clear water.

Arc Welding in Car Equipment Maintenance

Building Up of Worn Armature Shafts, Welding of Broken Motor Shells, Filling in of Flat Spots on Wheels and Welding of Large Variety of Broken Steel Castings Used on Cars Have Produced Far-Reaching Economies

THE growing possibilities of electric welding processes in connection with the maintenance of rolling stock and other railway equipment have been a source of amazement to every electric railway man who has come into contact with the practice. This began with the repair of broken members of the various parts of electric car equipment and has led to its use in a still larger field, which includes the building up of worn surfaces of steel parts which previously would have been headed for the scrap heap. The accompanying illustrations show some parts of electric car equipment which have been reclaimed by electric welding in the shops of several electric railways. This work was begun at a time when it was very difficult to obtain railway equipment parts and it has resulted in large savings and has enabled the equipment to be returned to service so quickly, that the work is being extended and used for defective-part repair which previously would not have been considered.

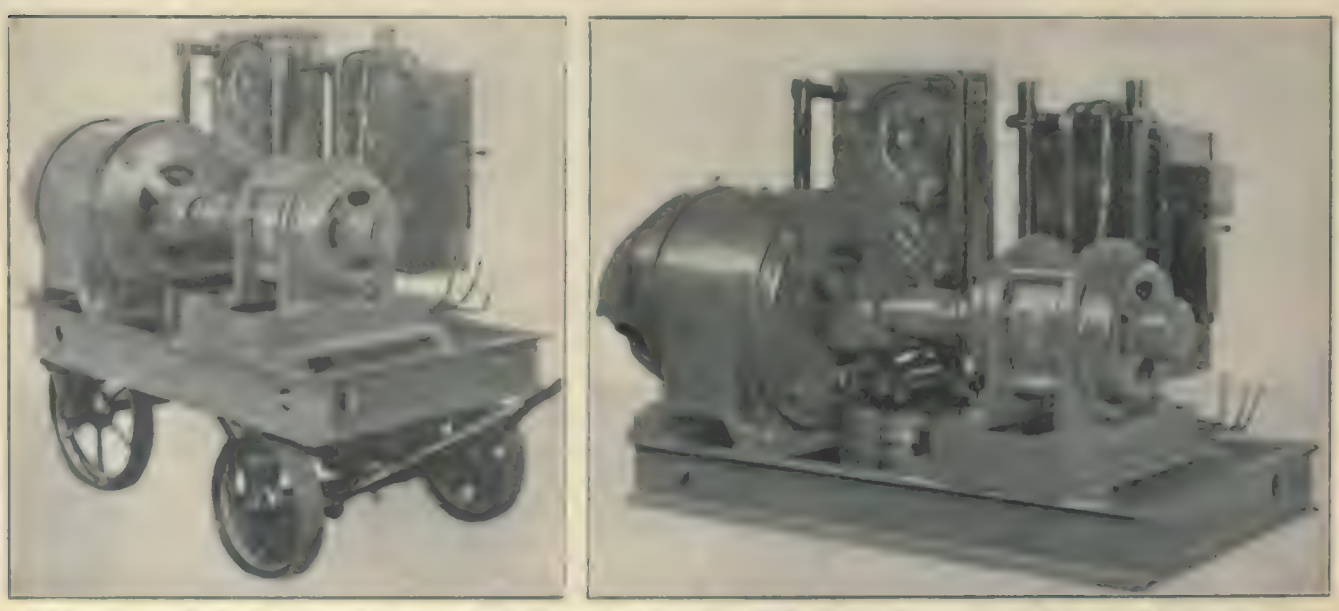


WELDING SPLIT GEAR INTO SOLID ONE

The United Traction Company, Albany, N. Y., constructed a special concrete building for its electrical repair work a year ago. A separate room was built at one end of this building and arranged particularly for electric welding, and all important details were incorporated in the design to fit this room for the purpose to which it was to be put. The building is a concrete structure throughout and the floor of the welding room is also of concrete. In dimensions this room is about 10 ft. x 30 ft. and it is entirely inclosed and separated from the rest of the building.

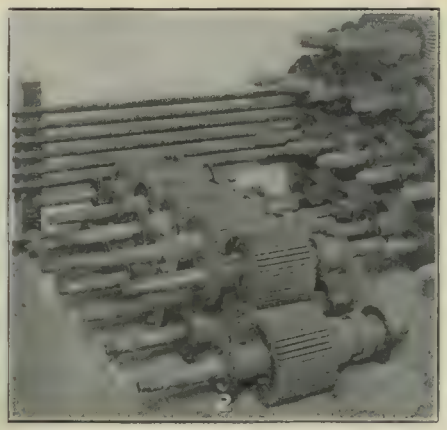
As a safety precaution no one is allowed to enter the welding room while work is in progress. Two observation windows are provided on either side of the entrance door, in which colored glass has been installed as a protection to the eyes of the observer. Any one having business in the welding room can see when welding work is being done and thus avoid the danger of any harmful effect from the light of the arc.

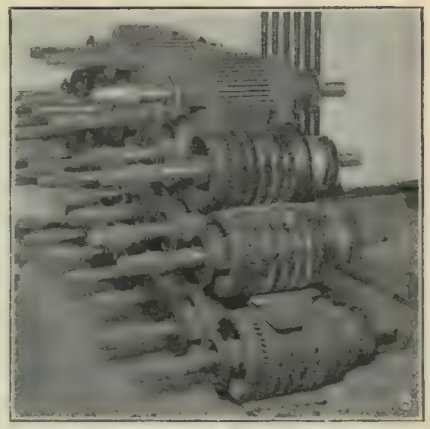
The equipment at present in use in the welding room consists of a General Electric motor-generator set and an oxyacetylene welding outfit, a welding table, convenient holders, masks and other welding equipment, and a chain hoist which travels on an I-beam the length of the room and also outside the entrance to pick up heavy work and facilitate the handling of heavy parts. Since the instal-



AT LEFT, PORTABLE WELDING OUTFIT FOR ELECTRIC WELDING. AT RIGHT, GENERATOR DIRECT CONNECTED TO MOTOR WITH CONTROL HANDLE AND STARTER







NO. 1—BROKEN CAST-IRON MOTOR SHELL RECLAIMED BY WELDING.
NOS. 2 AND 3—WORN ARMATURE SHAFTS BEFORE AND AFTER WELDING

lation of this equipment the General Electric Company has developed a self regulating welding generator which constitutes a part of its single-operator metallic electric arc welding equipment. This can be either stationary or portable and as it is self-contained it makes a very desirable combination. The generator has a two-pole armature, in a four-pole frame, with commutating poles, and generates sixty volts, open circuit. Bucking the shunt field is a series field, with taps brought out for different welding currents. As current flows from the main brushes through the series field windings it reduces the generator voltage to the proper welding value. Accompanying illustrations show some of the different types of welding equipment.

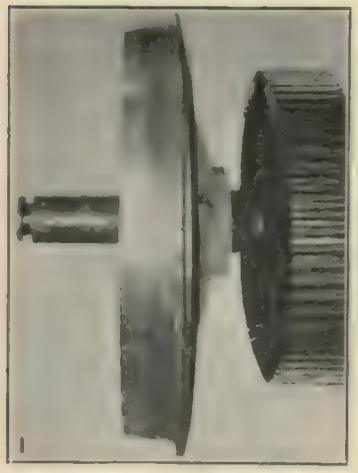
One of the most important operations and one which shows far reaching economies in the work undertaken by the United Traction Company is the building up of worn armature shafts. Accompanying illustrations show a number of these armature shafts before and after welding. The pinion ends of the shafts were "chewed up" due to the wear of the keyways for the pinions. The defective ends of the shafts which were to be repaired were carefully cleaned of all oil and dirt and sufficient metal was welded on so that the shafts could be remachined and rethreaded. A large number of these armatures were all right except for the damage to the keyways, so that they were returned to service as soon as the shafts were remachined and fitted. Others had damaged coils or grounded insulation and where it was necessary to rewind an armature this was stripped before the welding operations took place. For welding operations of this character where a large amount of work is to be done which is similar in character the General Electric Company has developed an automatic welding outfit. This was described in the ELECTRIC RAILWAY JOURNAL for Feb. 21. Its chief advantage lies in the increase in speed which is possible and the uniformity of welds which results. In the work done at Albany the building up and remachining of the shafts cost from $3 to $4 each, which was only about one-tenth of the cost of a new shaft. As local conditions as to labor costs as well as the cost of energy vary to quite an extent detailed costs for the various operations are not included, but on roads which are performing this work and which have actual data regarding the purchase cost of the various parts, the savings which result offer convincing proof of the economies which can be effected with the use of electric arc welding in this reconstruction period through which we are now passing.



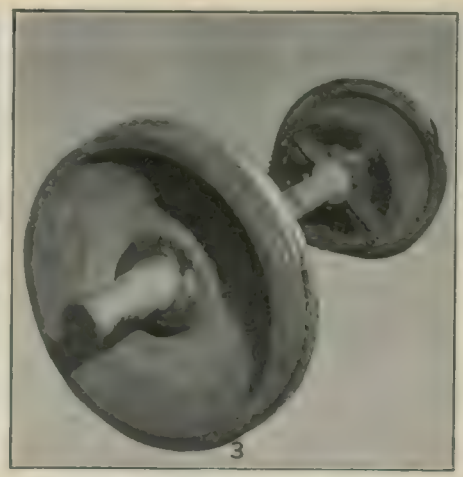
BROKEN CAST-IRON MOTOR SHELL AND AXLE HOUSINGS REPAIRED BY ELECTRIC WELDING (CASE BROKEN IN TWELVE PIECES)

Another illustration shows a pile of motor cases in the yards of the United Traction Company. Before the advent of the welding equipment many of these motor shells were intended for scrap due to various breakages and excessively worn parts. By the use of the welding equipment a large proportion of these have already been reclaimed.

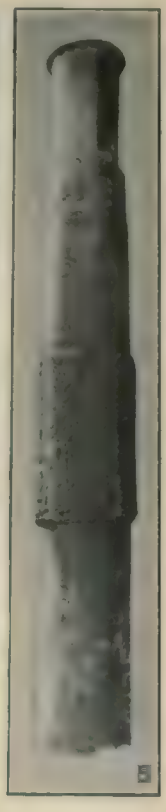
The method employed in welding broken lugs or broken ends of motor shells











No. 1—Wheel turned down ready for welding. Note thinness of flange.
No. 2—Flange built up ready to be shaped in wheel lathe.
No. 3—Finished wheel ready for service.
No. 4—Gear cases with patches welded on.
No. 5—Axle enlarged by welding for use with solid gears.

consists first in fitting the broken parts together and lining them up in their correct position. The pieces are then welded at a few points so as to hold the broken parts in position and, where necessary, the fracture is cut out "V" shape to provide additional space for the welding metal. Much of the success which has been obtained in his class of work at Albany is attributed to the use of studs for interlocking the metal which is added to the broken parts. Holes for the ⅝-in. studs are drilled and tapped at several points adjacent to the break and the studs are so inserted as to extend above the motor shell to about the same height as the thickness of the studs to which additional metal is to be added. The deposited metal is then allowed to bridge over these studs in welding and so obtains additional support which helps to strengthen the weld. In the illustration showing repairs made to a broken gear-case suspension arm, one of these studs can be seen projecting from the casting.

As an example of what can be accomplished, in repairing broken shells, the illustration showing a welded end of a motor shell alongside a lathe is an extreme case. This motor shell was broken in twelve pieces and from the illustration it will be seen that nearly the entire end was welded.

Another record job made in the shop of the United Traction Company was the welding of a truck bolster. The car, under which was a truck with a broken bolster, was brought to the shop and placed on a track adjacent to the welding room. The car body was jacked up and the bolster was repaired in approximately eight hours. The work was started at 9 o'clock after the morning rush hour and the car was ready for service again at 5:15 p.m.

In addition to the class of work illustrated as being done by the United Traction Company other interesting work is reported from various electric railways showing what has been accomplished. The Spokane & Inland Empire Railroad has done some work in reclaiming wheels with sharp flanges. Three views are given to illustrate the methods used. The first of these shows a wheel with the flange turned down ready to receive new metal. The second shows the flange with a new layer of welded metal. The third shows the finished wheel after it has been shaped up. After the new metal has been added the flange is merely shaped up with a forming tool. It is left quite rough in some cases, but as the practice has always been to put on new brake shoes when the wheels are repaired, the company has had no difficulty in wearing down the tread to a smooth contour. A number of steam railways are at present reclaiming all of their cold rolled steel wheels which are slid flat or have flaked-out places, as well as those with sharp flanges. This operation creates quite a saving in itself as often the car is merely placed over the drop pit and the work can then be taken care of with the car



MOTOR SHELLS WHICH WERE RECLAIMED BY WELDING

fully equipped. By this method the car is withheld from service but a short period. In the welding of sharp flanges it is not contended by those who have had extended experience that the metal deposited will give the life of the parent material, but they agree that savings are created as a result of maintaining the car in service until such time as it is necessary to shop it for major repairs.

Another example of reclaiming electric car equipment is shown in the repairs to gear cases. One of the illustrations shows a fair sample of the repairs that are frequently found necessary. In this case patches are made of No. 10 sheet iron. In welding these patches on, the operator first determines the size of the patch and outlines it with chalk on the old case. He then builds up a layer of metal just outside the chalk mark. The patch is then laid on and welded to a layer of metal. In this way a tight and secure joint is made. As gear cases are frequently covered with oil when they are brought in for repairs, they should be cleaned off as much as possible. In making a patch that requires a bend, as in the case illustrated, the operator first welds the patch to the bottom of the case, then heats the patch with his tool and bends it into shape.

Split Gears Made Solid

Some electric railways which have split gears have found it advisable to change these to solid gears by welding and then to press them on the axles. Accompanying illustrations show a gear which is being welded in this manner and also an axle which has been built up so as to increase the gear seat. The method employed in welding the gears consists, first, of cutting a "V" along the joint of the gear down to the bolts with a carbon electrode. The operator then builds up with new metal and welds each bolt. In order to increase the size of the gear seats on the axle, the operator welds a layer of new metal about 8 in. in length and fills up the old keyways. This seat is then remachined and a new keyway is cut. Broken teeth in gears have also been repaired by welding.

Another use of welding which has been of benefit to electric railways is in the maintenance of housings for the bearings of railway motors. Constant vibration and heavy jarring causes the fit in the motor frame to become badly worn and many railways have used shims to take up this wear. A small layer of metal deposited by the electric arc and then machined to the desired dimensions provides a more serviceable job than that of the shims, and when a tight fit is once secured, the wear is eliminated.

The filling in of bolt holes in various parts of the car equipment is another use which is showing far-reaching results. Heavy duty and constant vibration cause the holes to become worn, and the bolts then readily become loose and often fall out. The filling in of these holes and their redrilling takes very little time and the cost is extremely low.

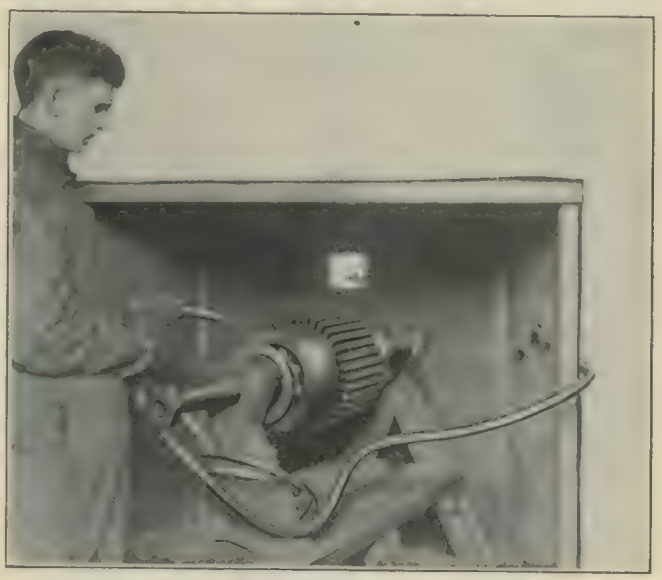
Some other welding operations which have been carried out with success are these: side bearings which have become badly worn have been built up, brakeshoe heads and hangers have been welded and truck side frames have been repaired in numerous cases. A large number of uses for electric welding are constantly presenting themselves to all railways. Enough instances have been cited to demonstrate the fact that the art of welding has greatly increased the resources available for lengthening the life of equipment.

This Makes Armature Cleaning a More Pleasant Job

A Home-Made Air Ejector Serves Admirably to Remove Dust-Laden Air from the Armature Cleaning Hood

THE Connecticut Company has in its Grand Avenue, New Haven, repair shops a simple and ingenious arrangement for carrying off the dust filled air around an armature which is being cleaned by compressed air. Similar devices were described in the ELECTRIC RAILWAY JOURNAL for March 15, 1913, page 485, and July 20, 1918, page 120. Everyone knows the discomfort of having to breathe this dirty air and of being covered with a layer of armature cleanings. Also, the whole shop after a while gets a deposit of this sticky and annoying dirt.

The arrangement referred to, and shown in the accompanying illustration, consists of a canvas-covered cubical compartment, open on one side and contracting



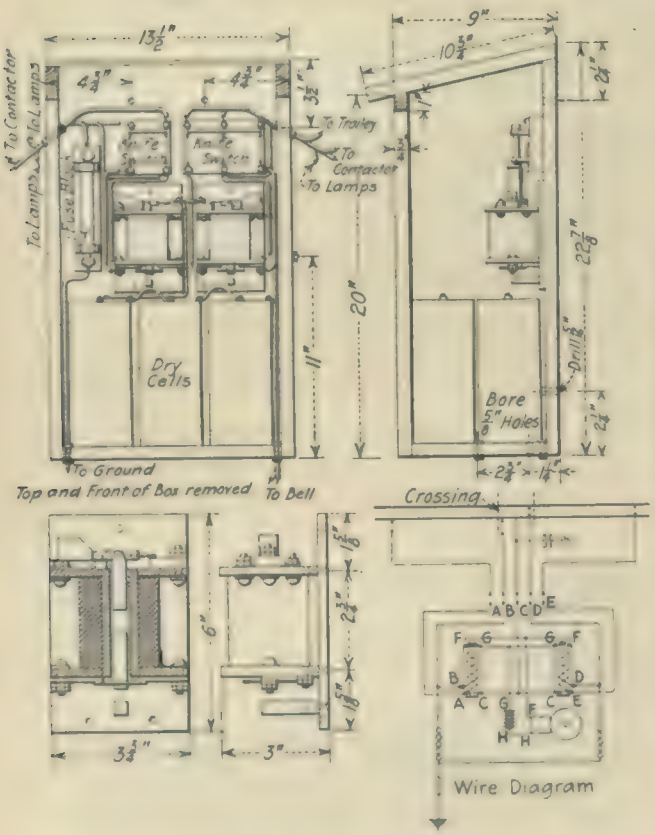
CHAMBER FOR CLEANING ARMATURES BY COMPRESSED AIR

on the opposite side to a sort of flue or horizontal pipe which leads out doors through a wall or window. Whenever compressed air is turned into the hose and nozzle used by the operator to blow out the armature, compressed air is also turned into a branch pipe which is in the center of the flue and thus causes a draft through the flue. This draft can draw only from the compartment and so carries away the dust filled air.

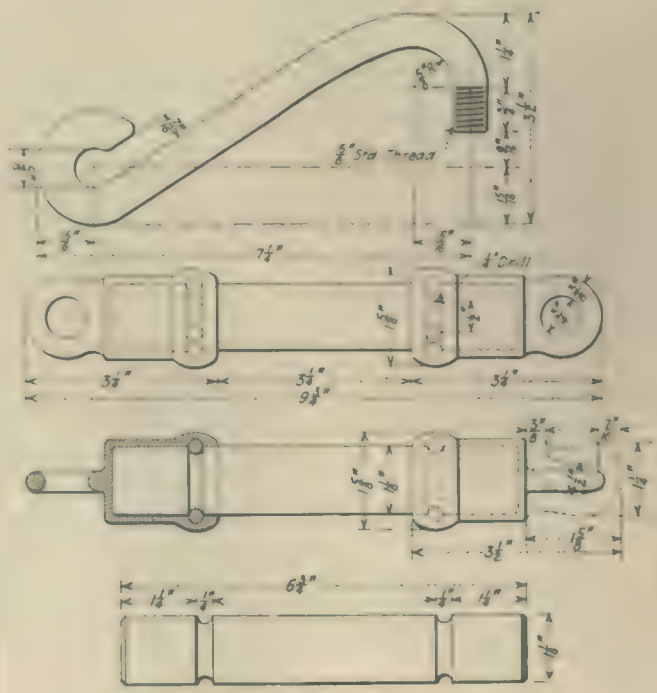
This "ejector" for creating a draft out of the hood is used here in place of a fan on account of its simplicity. While for continuous service an electrically-driven blower would undoubtedly be more efficient, this scheme serves well here, because the apparatus is used only intermittently. It is another illustration of the utility of compressed air in and about the shop.

The construction is simple and inexpensive. The compartment is about five feet cube — merely a wooden frame covered with canvas. The flue is about ten inches square and eight or ten feet long. Armatures are wheeled into the open side of the cube on the usual wheeled horse or rack and cleaned in the usual manner by air blast. This particular installation has been in satisfactory use for several years.

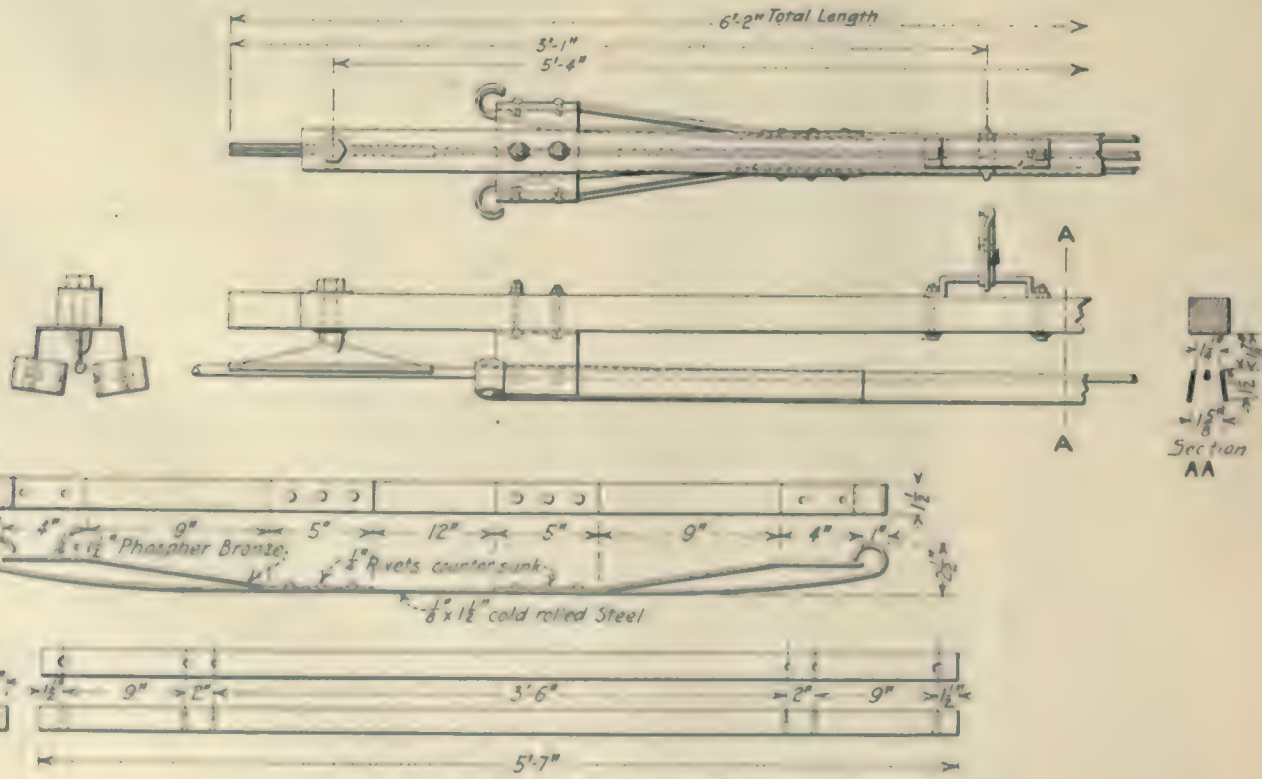
Detail Drawings Illustrating Signal Maintenance and Overhead Kinks



CONSTRUCTION DETAILS OF DOUBLE TRACK CROSSING SIGNAL RELAYS AND BOX



CONSTRUCTION DETAILS OF STRAIN INSULATOR AND NEW GOOSE-NECK



DETAILS OF CONSTRUCTION OF CROSSING SIGNAL CONTACTOR

Signal Maintenance and Overhead Kinks

A Description of Double-Track Crossing Signals and Other Overhead Equipment Developed on the Minneapolis Street Railway in an Effort to Reduce Maintenance Work



THE MINNEAPOLIS SIGNAL CONTACTOR IN SERVICE



SIGNAL LIGHT, RELAYS AND BELL MOUNTED ON POLE AT CROSSING

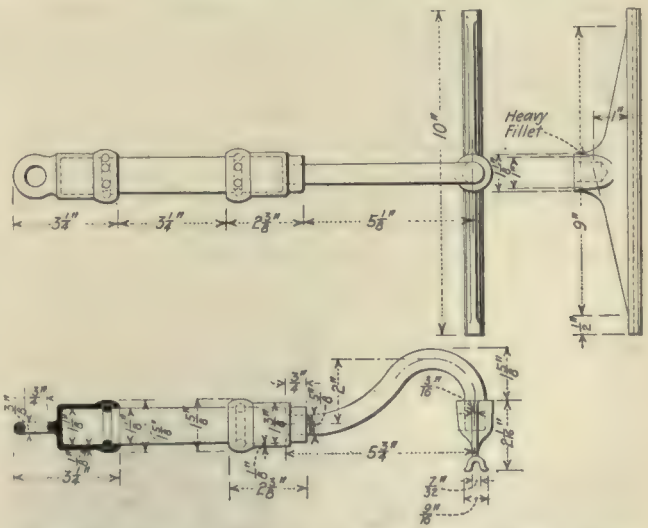
ON THE lines of the Twin City Rapid Transit Company, Minneapolis, Minn., several pieces of equipment have been developed recently by the overhead department. These include such apparatus as double-track crossing signals, special pull-off goose-neck and strain insulators, electrically-lighted switch lamps, etc. The maintenance of signals on this property is taken care of by the same crew which looks after all of the overhead maintenance, including telephone lines. A description of the equipment with which this maintenance work is accomplished appeared in an article in the July 19, 1919, issue of the ELECTRIC RAILWAY JOURNAL, page 121.

The drawings on page 578 show the construction details of a double-track crossing signal, relays and box, used on the suburban lines of the Minneapolis company. The object of the double equipment is that cars passing in one direction will not check the operation of the lights and bell for cars going in the opposite direction at the same time. A second drawing shows the details of construction of the trolley contactor used in connection with this crossing signal.

In operation the trolley wheel of the car makes a contact with the cut-in hanger placed approximately 1,300 ft. from the crossing. This contact lights the bank of lamps over the signal relay box, and the current for the lights energizes the coil which closes the trolley circuit contact to keep the lights burning and also closes the battery contact which keeps the bell ringing until the car reaches the crossing. At the same time the station is also illuminated, showing passengers waiting for the car and warning passengers of the approaching car. At the crossing the wheel makes a second contact with the trolley contactor and this acts as a short on the relay coil allowing the armature for the trolley contact and the battery current to be released. This causes the bell to cease ringing and extinguishes the lights. The locations of the bank of lamps, the relay box and the signal bell are shown in an accompanying photograph.

The relay boxes are constructed of ⅞-in. pine lumber and receive two coats of light olive paint. The bell is a 10-in. gong, furnished by the Union Railway Signal Company. The contactor is made of cold rolled spring steel and the trolley ear suspension bar is made of ash saturated with hot linseed oil and painted with two coats of black insulator paint.

Another device shown in an accompanying drawing and a photograph is a goose-neck and strain insulator that is being used at the present time. One illustration shows the standard pull-over that has been in use for a number of years and another the strain insulator and goose-neck now being used. It will be noted that the old goose-neck is threaded at both ends and the wood strain



CONSTRUCTION DETAILS OF STANDARD PULL-OVER

insulator has an eye on one end and the other is tapped to allow the goose-neck to be screwed into it.

The wood strain insulator is used to cut into the span wire next to the trolley. The one with the eye in both ends is used for regular installation, and that showing the eye in one end and the hook in the other end is used to replace one which may be broken for any cause. The



PULL-OFF GOOSE-NECK IN SERVICE

eye in the strain insulator is shown with the goose-neck threaded through it, so that the span wire can be hooked into the end of the insulator without the necessity of undoing the ends of the span wire. A photograph shows the new goose-neck with the two insulators attached to it and with the safety jumper over the top, so that in case either of the insulators is broken the span wire will not hang down from the trolley on the opposite track or from the pole. In the same way of substitution, one of these insulators with the hook on one end can be used as in the case previously described.

The advantage of the new goose-neck is that it will be necessary to carry in stock only the wood strain insulator with the eye in each end and the one with the eye in one end and the hook in the other. This will permit doing away with the insulator which has the eye in one end and the other end blank and tapped to allow the old goose-neck to be screwed into it as shown in the illustration.

An accompanying photograph shows an electrically-lighted switch lamp. A short distance away from the switch lamp is a box attached to a pole with a long arm reaching out from the pole toward the track. This arm is to enable the motorman to turn the switchlight on and off without leaving the cab of his car. The lamps are in series with other lamps on the pole, thus making up the necessary number for a series-burning circuit. At some of these switch locations, part of the extra lamps have been installed in the telephone booths at various places along th line where the motorman stops to get his orders from the dispatcher. Thus at night he is furnished with light to see that he makes proper notation of the dispatcher's orders.

In the box on the pole is a 3-amp. switch. The extension arm is ordinary ½-in. pipe of the desired length, fastened to the box by a floor plate and with a bracket as an additional support. Inside the pipe is a rod connected to the button on the switch and with a handle on the outer end with which to turn the switch on and off. There is no indicator to show the position of the switch as it is a simple matter, if the lamps do not light, to give the handle an additional turn. The lamp on the switch stand is one of the old pattern of oil switchstand lamps with the tank and burner removed and a wall socket attached to the inside of the cover. Thus the incandescent bulb hangs in a vertical position and by opening the cover of the lamp, the bulb is conveniently inspected.



OIL TYPE OF SWITCH LAMP WIRED FOR ELECTRICITY

Electrification Considered in Chicago

At a joint meeting of the Chicago sections of the A.I.E.E. and A.S.M.E. and the electrical and mechanical sections of the Western Society of Engineers, held at the Western Railway Club on March 4, S. T. Dodd, General Electric Company, Schenectady, presented an illustrated talk giving "some comments on the present status of steam railroad electrification." In pointing out the extent to which trunk line electrification has advanced to date, Mr. Dodd stated that 1,239.59 miles of route and 2,706.45 miles of track in the United States are now electrified. There are 364 electric locomotives and 1,020 motor cars in use on these roads.

The theme of the paper was the tremendous saving in coal that could be realized through a complete electrification of the steam roads, this tending to show the economic necessity of early electrification. The speaker gave figures to show that practically 15 per cent of the total ton-miles of steam road operation is of a non-revenue character, a waste which could be eliminated through electrification. The immense consumption of coal by the railroads was emphasized by pointing out that 24 per cent of the total coal production of the United States and 5.8 per cent of the total oil marketed in the United States in 1918 were consumed by the steam locomotives. The total saving in coal which could be brought about through the elimination of the non-revenue ton-mileage under steam-road operation, and the more efficient burning of the coal in large generating plants as compared to the inefficient burning in steam locomotives, would be 122,500,000 tons per year.

N. F. P. A. to Hold Public Hearing

THE electrical committee of the National Fire Protection Association, on which the American Electric Railway Association is represented by Martin Schreiber, will hold a public hearing and committee meeting in New York City on March 23 and 24, at which the revision of the rules regarding carhouse wiring will be considered. The standing committee on cars and railways, consisting of Mr. Schreiber, R. C. Bird and Ralph Sweetland, will recommend the revised rules for carhouse wiring, which were approved by the Engineering Association at the Atlantic City convention.

The committee will report that the subject of carhouse wiring was given consideration because Rule 41 of the "Code" had become out of date, but that it was the desire of the committee to preserve as far as possible the intent of the old N. E. C. rules, but to put them in a form that would meet the wishes of the various parties interested. As the new section 41 was printed by the Engineering Association and distributed in advance of the Atlantic City convention, it will not be necessary to reprint it here.

Handling Wet Sand From a Hopper

The Writer Describes How the Daily Output of a Sand-Drying Plant Was Increased and the Cost of Operation Decreased

BY HOWARD H. GEORGE
Assistant Engineer, Public Service Railway of New Jersey, Newark, N. J.



PANORAMIC VIEW OF PUBLIC SERVICE SAND PLANT

PRACTICALLY every street railway company is obliged to provide dry sand for one purpose or another in the operation of its system. Where comparatively small quantities are required the problem is of course very simple, but as the total requirements increase, the ordinary equipment, which generally consists of a stove surrounded by a perforated cylinder within which the wet sand is placed, or some similar arrangement, fails to turn out dry sand in quantities sufficient to meet the demands. Recourse must then be had to the rotary type of dryer and the experience described in this article may prove of considerable interest to railway men who are facing the problem of increasing the efficiency of their plants and decreasing the operating costs.

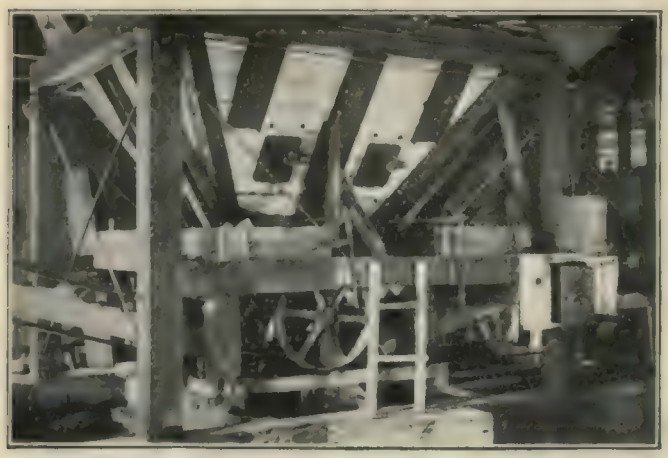
All of the sand used on the Public Service Railway in this section is dried at a central plant located on a river front at our main material storage yard. The sand is received on scows and unloaded on the dock immediately adjoining, by means of a stationary stiff-leg derrick equipped with a grab bucket. The sand-drying house is located within easy reach of the swing of the boom of the derrick.

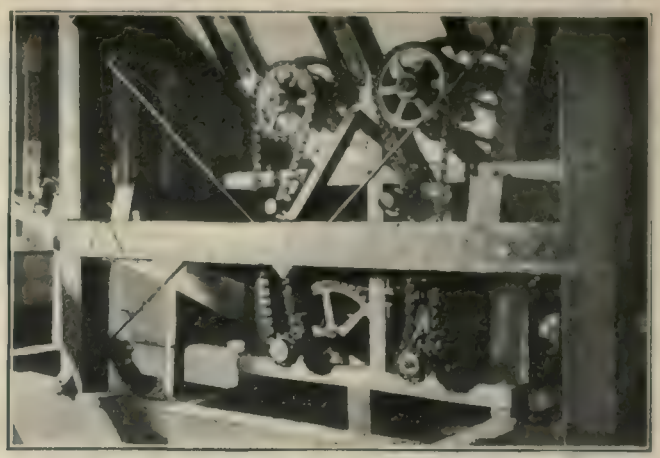
A few years ago the writer was assigned the work of studying the operation of the plant, to determine what improvements could be made in its operation. The first step was the determination of the actual output, and for this purpose arrangements were made to run a test of the plant as it stood, over a considerable period of time.

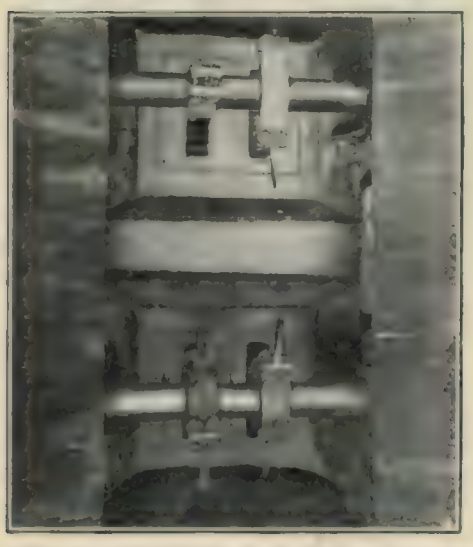
Before discussing these tests, I shall explain the operation of the plant as it was conducted at the time. The equipment consisted of two electrically-operated revolving drying drums, hard coal being used for fuel with forced draft. In front of these dryers was a floor space in the center of which the wet sand was deposited by bucket through an opening in the roof. Belt conveyors led from each side of the sand pile and fed into the upper end of the drums. Upon rejection at the far end of the drums, the dry sand dropped into small pits where it was picked up by bucket-chain conveyor elevators and raised to the storage bins. Each half of the equipment was entirely independent of the other. One man was required to attend to the fires and operate the machinery and another had to devote a part of his time to operating the clam-shell bucket. A minimum of four laborers were required to shovel wet sand from the pile to the belt conveyors when both units were in operation, which was ordinarily the case. If it was desired to work the plant to its capacity it was necessary to have additional laborers shoveling sand in order to keep the delivery to the drums reasonably uniform, for, although a man can shovel at a lively rate at the beginning of a day's work, his efficiency falls off rapidly as the day approaches its end, until it is not unfair to him to say that it is probably only about 25 per cent at the end of the day.

CAREFUL RECORDS MADE

In order to obtain the necessary data for a fair analysis of the existing conditions, a number of forms for use in the tests described below were prepared and used with excellent results. The dry sand storage bins were measured and carefully gaged and during the test all sand was leveled in them at the end of each day's run. Every sand car which took dry sand for delivery to carhouses or for direct application to slippery rails was also measured, and its capacity was registered against it and a record was kept of the number of times it called each day for sand. A part of the dry sand was bagged for delivery to points where the sand storage bins were not within shoveling distance of the car, and a record was made of the quantity of sand bagged each day. Determination was also made periodically during the day of the weight of a given volume of wet sand, the measuring box being filled in a manner approximating as closely as possible the condition of the wet sand in the pile. This sand was then



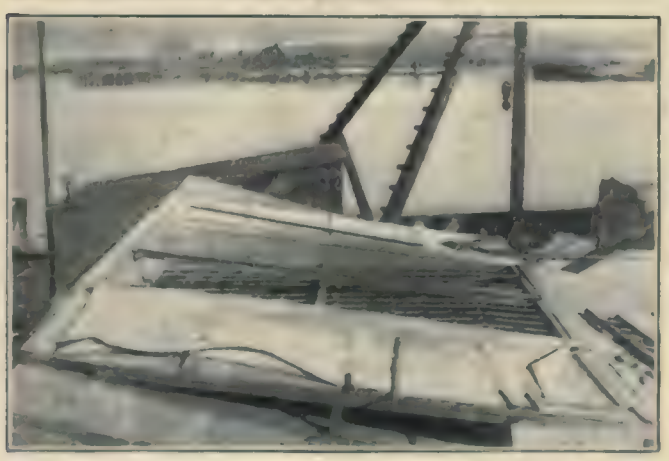




Plant for Handling Wet Sand

At top, front and rear views of sand hopper. At left, looking down into hopper. At right, gear and pinion drive for drum. Below at left, grating and hinged doors over hopper. Below at right, main and auxiliary belt conveyors. At bottom, left, one of the main conveyors with fire-box at head of drum. At bottom, right, revolving drum with dry sand bucket elevator.











carefully dried and again weighed to determine the loss in weight due to evaporation of moisture and the sand was also remeasured to determine its shrinkage in volume. The coal in each bin was weighed at the beginning of each day and again at night, together with any additions during the day's run. Watthour-meter readings gave the power consumption. This showed a total of 79 kw.-hr. for the 530 cu.yd. of wet sand dried during the first test period, the total coal consumption for the same period being 22,973 lb. The test showed that there was an average evaporation of 2.32 lb. of water per pound of coal consumed and that the coal consumption averaged 1.90 lb. per cubic foot of dry sand. Note was also made of all other materials used in the operation of the plant, such as oil, grease, waste, etc. The test covered a period of eight working days, the actual operating time being 62¾ hours.

TABLE I—RESULTS OF TESTS OF SAND-DRYING PLANT

	Before Making Changes	After Making Changes
Total cubic yards of wet sand dried	529.71	467.40
Total cubic yards of sand after drying	452.38	399.17
Total duration of test, hours	62.75	31.50
Weight of coal burned, pounds	22,973	11,595
Labor, man-hours	300	105
Water evaporation per pound of coal, pounds	2.32	4.165
Coal consumption per cu. ft. of dry sand, pounds	1.90	1.075
Total energy consumption, kilowatt-hours	79.0	61.4
Output of dry sand per 10-hr. day, cubic yards	72.09	126.72

With the information thus obtained it was possible to state with reasonable accuracy the actual output of dry sand per day and the various items entering into its production. In studying the problem and analyzing the results of the test, it was at once evident that the big leak was in the delivery of the wet sand to the drying drums. The necessity for keeping the belt conveyors running full emphasized the necessity of some mechanical device for feeding the wet sand. Investigation was accordingly made of the possibility of satisfactorily handling wet sand from a large hopper or receiving bin and the best method of delivery from such a bin to the main belt conveyors, so that the flow of sand to the drums would be continuous and uniform. Any one who has had any experience with wet sand knows how it packs and arches when dumped into a hopper, the extent of such action varying considerably with the degree of moisture in the sand. Also they have probably experienced difficulty in handling such sand during freezing weather.

New Hopper Helps Conditions

The result of our study of the problem was the development of the machine shown in two accompanying illustrations, which also show the chain drives for operating the two agitator shafts referred to later.

Experiments which we made determined the practical minimum slope with which the bottom of the hopper had to be designed in order to insure free slippage as the wet sand was run out of the bottom of the hopper. Two parallel openings were provided in each half of the bottom, each pair feeding to one of two short auxiliary belt conveyors which in turn delivered the sand to the main belts. The size of these openings could be made larger or smaller as the needs required depending upon the degree of moisture in the sand. Arching was prevented by running two large shafts through the hopper over the valve openings and just below the point where the arching would take place. Keyed into each of these shafts were two cutting blades set at right angles to each other, each rotating so as just to cut through their respective openings when in the lowest position. These blades or agitator bars cut through any sand that might arch above and keep it churned, and in addition keep pushing it through the valve openings onto the belts. At the end of these blades where the wear is greatest, they were finally reinforced by doubling their section. The view looking straight down into the hopper from the top shows the two shafts, the four agitator bars and the openings through which the wet sand is fed to the two auxiliary belt conveyors.

No difficulty is experienced in controlling the flow of sand perfectly during ordinary weather. In the winter when the sand is apt to contain large frozen lumps, these lumps are rejected by a steel rail and pipe grating which was constructed across the top of the hopper. The openings are of such a size that any lumps passing through them will be handled through the valve openings below without any trouble. In the view showing this grating the hinged doors by which the opening is closed during freezing or very rainy weather when the plant is not in operation can be seen. It is, of course, necessary for a man to climb up and break such larger lumps as remain on the grating. The only precaution which must be taken in freezing weather is to see that the hopper is run until empty at the end of each day's work.

The apparatus is driven by a 10-hp. motor, controlled from a starting rheostat. The size of the openings is regulated by sliding plates connected to levers located in the center of the mechanism, one of which appears on each side of the small ladder in the center of the view of the hopper. These levers move the valve plates forward and backward.

Force of Three Men Used

On man operates the hopper and also breaks up any lumps which may collect on top of the grating. Another man tends the two fires and operates the other machinery, and the services of still another man are required a part of his time to keep the hopper filled, the remainder being devoted to operating other machinery around the yard. In this way the services of a minimum of three men were dispensed with in the operation of the plant and it was possible greatly to increase the production through the constant and uniform feeding of wet sand into the drying drums.

This steady flow is evident in the illustration which shows sections of both the main and auxiliary belt conveyors at the point where the sand is transferred from one to the other. When two men were feeding each belt it was our observation that there would be about one shovelful of sand to every 6 or 8 ft. of belt. The hopper machinery was so designed that either one or both sides could be feeding at the same time, and either side could be shut down when not required.

At the time the tests were first run, the drum was rotated by a friction drive. It was noticed that any attempt to feed wet sand into it beyond a comparatively low rate resulted in stopping its rotation, although in ordinary operation, with two men shoveling on each belt at their regular rate, this point was never reached. As the result of this observation, and in view of the fact that it was planned to have the belt conveyors running full, it was decided to change the drive, and a gear-and-pinion drive was substituted. This appears in detail in another illustration.

The work was started late in the fall and completed

the first of the following year, including the time required to make certain changes from our original design which experience later proved to be necessary. The remodeled plant has now been in regular operation for several years during which repairs have been limited to an occasional replacement of a worn gear, pinion or broken link in the chain drive, and an occasional replacement of a worn agitator bar.

When the construction was first recommended we estimated that it would save more than its first cost in reduced operating expenses the first year. The tests run after the plant had been in operation after all the changes had been completed proved that it would do even better than this. Actual costs have not been given for the reason that the plant was remodeled at a time when the cost of both labor and material was quite low and these costs would mean practically nothing now, when the items composing them have advanced anywhere from 100 per cent to 400 per cent, but the data given in the accompanying table show very well what was accomplished in this particular case.

New Cars in Atlanta

TWO views of one of the new cars recently placed in operation by the Georgia Railway & Power Company, Atlanta, are shown herewith. The new cars are of the center entrance and exit type but built without a well in the center. The floor level of the cars is reached by three fixed steps inside the car of 15½ in., 12 in., and 11 in. heights. The center double-door opening is 48 in. wide and the conductor's position is opposite the entrance. A 30-in. folding door at each end of the car equipped with one folding and two fixed steps and having the same step heights as prevail at the center entrance is provided for the use of the motorman only. All seats except those in the two vestibules and the folding seats at the center of the car are of the cross-seat type. In general, the car is of semi-steel construction, measures 44 ft. long overall, 8 ft. wide over the side plates, and weighs 34,000 lb. It is equipped for double-end operation and the platform at each end measures 5 ft. to the bulkhead. The cars are mounted on Brill 39-E maximum traction trucks equipped with General Electric 201-1 motors, and K-35 control, and General Electric straight air brakes. The trucks are mounted on 23-ft. centers and the wheelbase is 4 ft. 10 in. The cars seat fifty-one passengers. The height of the cars is 10 ft. 10 in. from rail to top of trolley boards, and 7 ft. 6 in. from floor to headlining. The cars were built by the American Car Company, St. Louis, Mo.



INTERIOR VIEW OF ATLANTA CAR

The Public Service Railway of New Jersey, which made a highly creditable record for good service during and after the recent heavy snows, reports excellent results from the "Detroit drag-board" described last in the issue of this paper for Aug. 31, 1918, page 371. To quote a high official of the company they proved a "life saver." They will be put on old single-truck cars for emergency snow fighting. At Camden the local master mechanic has applied the boards to some double-truck cars.



NEW TYPE CENTER-ENTRANCE AND EXIT CARS RECENTLY INSTALLED IN ATLANTA, GA.

Reclamation Shop Effects Saving of More Than $86,000 in 1919

Centralization of Maintenance, Special Construction and Salvage Work on Connecticut Company's System Results in Large Economies



GENERAL VIEW OF MACHINE SHOP OF CONNECTICUT COMPANY'S RECLAMATION SHOP

NEARLY two years ago, the officials of the Connecticut Company believed that large economies could be realized in the maintenance of rolling stock by centralizing in one shop the reclamation and special construction jobs and all except the routine maintenance work for the entire system. Thus, as was described in the issue of the ELECTRIC RAILWAY JOURNAL for Aug. 31, 1918, a reclamation shop was installed at New Haven, Conn., about January, 1918, in what had formerly been an old paint shop and storage house. Since the publication of that article, the shop has been in continuous operation, and figures and facts are now available to show what has actually been accomplished.

The work of the reclamation shop might very properly be divided into three classes; maintenance, special construction and salvage. The maintenance work covers those jobs which can be done in quantity, such as boring and babbitting armature and axle bearings and rewinding armatures, and such work as overhauling compressors, repairing headlights and trolley catchers, refilling fuses, etc. In fact all but the light routine repairs are handled in this shop. Probably the largest single item of maintenance is the rewinding of armatures.

Since the previous article appeared, the armature department has been moved from the main floor and a special room constructed, forming a second story over the welding shop. This department now employs eight men and seven women and handles practically all of the armature and coil work for a rolling-stock equipment of some 2,000 motor cars. The equipment in this department includes an armature-coil winding machine, a field-winding machine, two banding lathes, a lathe for turning commutators and equipped with an attachment for slotting commutators, and a special lathe for winding contact magnets and other cylindrical coils.

Under the heading of special construction jobs which are handled in the reclamation shop might be included those items which are manufactured, such as trolley wheels and harps, axle bearings and collars, door castings, truck axles, brakeshoe heads, armature-coil winding, turning down axles from the rough, etc. In addition to these should be mentioned such special jobs as the construction of a steel ash car welded throughout and a 900-gal. underground oil storage tank.

The equipment in the machine shop for handling these diversified jobs includes three engine lathes, turret lathe, boring mill, axle lathe and keyseater, two drill presses, hacksaw machine, two emery grinders, 100-ton wheel press, axle straightener, 24-in. shaper, 26-in. x 8-ft. planer, babbitting machine, small sensitive drill, small speed lathe and bolt cutter. For use with this equipment in handling maintenance work, many special jigs have been planned and built. Several of these were covered in the previous article on the reclamation shop. A few of the others are described in the following paragraphs.

In the line of salvage work handled at the reclamation shop, welding is the main item. This includes building up axles at the journal and the axle bearing seat, welding motor frames, building up and welding of Westinghouse 101 armature housings, repairing truck frames and line tools, building up and welding together broken armature shafts, welding gear cases and journal boxes, etc. Steel wheels have also been successfully built up and switch tongues and switch parts are repaired for the track department. Occasionally also the welder is called out on special jobs such as welding boiler tubes, stoker parts and engine cylinders at the power plant. Probably the one item which forms the largest percentage of the work handled in this department is the repair of gear cases.

Another item which forms a large part of the welding work is the repair and rebuilding of journal boxes from Standard 0-50 trucks. When these boxes come into the shop the outer shell on the back side is badly



HALF OF THE FORCE IN THE ARMATURE DEPARTMENT ARE WOMEN

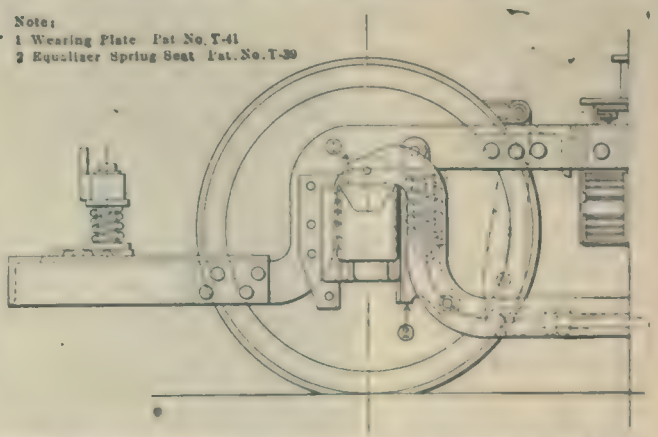
worn and often worn entirely through by the wheel, as shown in an accompanying group illustration. The boxes are also badly worn on the top by the equalizer bars and the equalizer spring seat is often cracked or badly worn. In the latter case the first step is to knock this seat off with a cold chisel. The various steps in the rehabilitation of these boxes are shown in the group illustration referred to.

After the spring seat is knocked off both the sides and the top of the box are planed off in the big planer. The top is smoothed and the sides are made 5¾ in. between faces with the equalizer bar guides ¾ in. deep. If the shell is only badly worn on the wheel side it is built up with the electric welder, as is also the worn surface on the top. If, however, the shell is worn entirely through, a piece of ⅜-in. or ½-in. boiler plate is welded over the face and the hole is later cut out either by means of the arc or the acetylene torch.

A special spring seat and wearing plate have been made up to replace the parts planed off. These are shown in an illustration and their application to the truck is also illustrated. The cost of repairing the boxes depends upon the amount of work which has to be done upon them, in other words upon how badly worn they are. On various jobs the cost has been anywhere from $1.99 to $4.25 per box with a general average of perhaps $2.25. Sometimes as many as fifty boxes per month are repaired in the foregoing manner.

The various jigs which have been built are simple in construction but greatly simplify the operations for which they have been designed. An accompanying photograph shows the attachments made for use on the bed of the 24-in. x 26-in. x 8-ft. Woodward & Powell planer. These attachments, which are plain castings with two V-shaped rests, permit the simultaneous planing of eighteen axle-bearing halves, of the same size. For this work a special head was also made up in two parts and mounted on the standard head of the machine. This special head provides for adjustment of the cutting tools laterally so that the four tools will always be cutting simultaneously regardless of the size of bearings being planed. The head rests against two adjustable supports which hold it in a vertical position and relieve the strain when the tools are cutting.

The supports which hold the axle bearings in place are dovetailed to the bed of the planer and the bearings



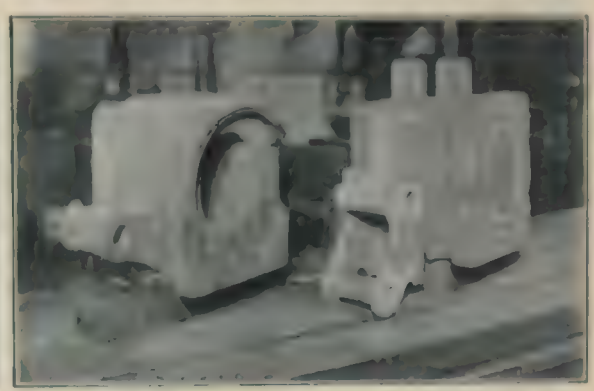
APPLICATION OF REHABILITATED JOURNAL BOX TO TRUCK SHOWING NEW SPRING SEAT AND WEARING PLATE IN POSITION

are held in position by clamps which are bolted down, a single clamp holding the adjacent ends of two bearings. With this equipment it is possible to plane off eighteen axle-bearing halves in approximately forty minutes.

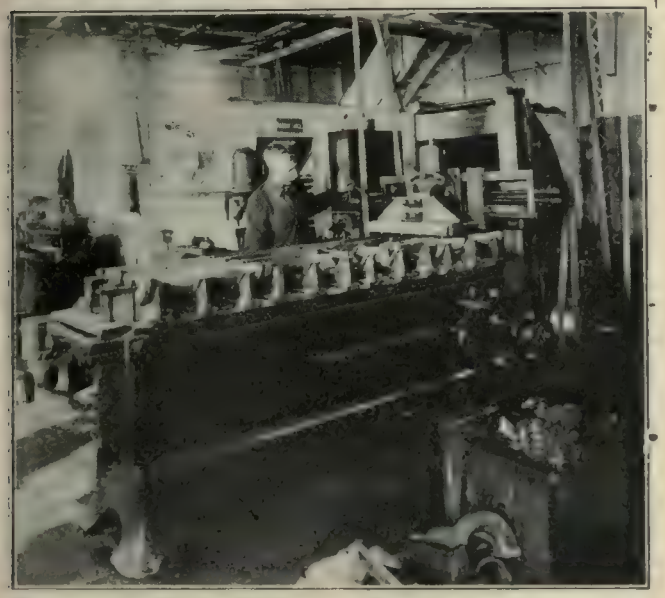
Another jig, which is illustrated, facilitates the correct and speedy drilling of axle bearings. This box-shaped device is made of steel, the several pieces being held together by steel dowel pins. The construction details are shown in the accompanying illustration. This jig is adjustable to accommodate any size of bearing and the bearings may be so easily and quickly inserted and removed that approximately forty halves can be drilled per hour. The segment marked "A" on the illustration



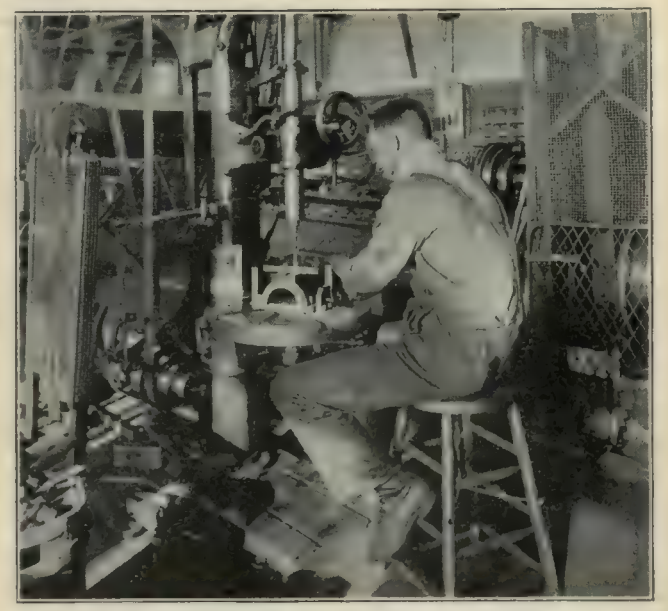
SUCCESSIVE STEPS IN REHABILITATION OF WORN AND BROKEN JOURNAL BOXES—STEPS PROGRESS FROM RIGHT TO LEFT



SPECIAL SPRING SEAT AND WEARING PLATE WHICH REPLACE PARTS BROKEN AND PLANED OFF



ATTACHMENTS TO LARGE PLANER PERMITTING SIMULTANEOUS PLANING OF 18 AXLE BEARING HALVES



THIS JIG MAKES IT POSSIBLE TO DRILL ABOUT FORTY AXLE BEARING HALVES AN HOUR

is that part which is interchangeable to accommodate the various sizes of bearings.

For the drilling operation the bearing is slipped into the box until the fillet rests firmly against the segment "A." The thumb screws are then tightened to hold the bearing firmly in position and the hole is drilled. The adjustable segment is held in the box by the four screws. All segments have these four screw-holes so arranged that the length of the segment beyond the box brings the one or two dowel holes, as the case may be, in the proper position for the particular bearing for which the segment is designed.

A third device which is illustrated is that for drilling dowel holes in armature bearings and is quite similar in operation to that already described for the axle bearings. Because of the shape of the armature bearing, the box in this case has a hinged top and a cam lever to hold the cover firmly shut when the bearing is in position. In the bottom of this box there is an interchangeable lug which fits into the window of the bearing and prevents any rotating movement. The adjustable segments are made and used on the same principles as those already described and are held in position by two screws. The two illustrations, one showing the box closed with the bearing in position ready for boring and the other with the lid raised, show clearly the details of construction. With this jig about forty bearings per hour can be drilled. In both of these jigs the drill holes are lined with tool steel bushings.

A special arrangement which greatly facilitates the babbitting of armature bearings is also illustrated. The device consists of a working stand through which is



ALL BEARINGS WHICH ARE BABBITTED ARE BROACHED RATHER THAN BORED



WITH THIS MACHINE ONE MAN CAN BABBITT 100 BEARINGS A DAY

DUPLICATE

SHOP ORDER No. _____

_____ 19__

Mr. _____

_____

Please _____ as follows

_____

_____

_____

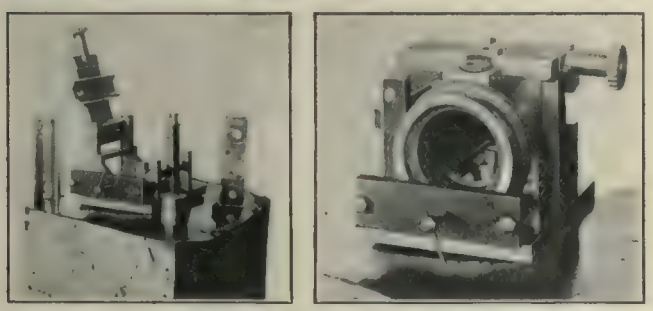
TABLE I—ESTIMATED MONTHLY SAVINGS FROM WELDING AND REPAIR JOBS DURING 1919

Class of Work	January	February	March	April	May	June	July	August	September	October	November	December	Total
Welding	$3,555.32	$3,650.50	$3,057.95	$2,423.63	$5,512.19	$2,015.08	$3,653.50	$3,055.15	2,189.10	$2,697.58	$902.20	$2,078.42	$34,780.62
Repairs	2,469.16	1,618.57	2,521.78	1.952,48	2,454.11	2,424.09	3,258.40	2,169.92	1,923.37	2,061.65	868.47	2,269.47	25,991.47

inserted the plunger of a 16-in. air cylinder. The piston of this plunger is removable and any diameter of piston can be used to suit the desired interior diameter of the babbitted bearings. The outside cylindrical form is bolted to the table top and has a hole in the base slightly larger than the largest piston which may be used. This form is interchangeable for the various sizes of bearings.

In the babbiting operation a ring, whose outside diameter is the outside diameter of the bearing to be babbitted and whose inside diameter fits snugly the piston to be used, is placed in the bottom of the outside form and over the piston. The semi-cylindrical plates shown are then placed around the bearing, one plate having an interchangeable lug which fits the window of the bearing. These plates are also long enough so that when this equipment is placed in the cylinder over the piston, the plates surround the ring already in place. This insures the proper centering of the piston.

As soon as the babbitt is poured the piston is withdrawn. This piston is hollow and is water-cooled as withdrawn. The babbitt cools and shrinks so quickly that the piston can be almost immediately raised and lifts the bearing with it. This is then placed at one side and the operation repeated. With this device approxi-



THIS TYPE OF JIG IS USED TO DRILL ARMATURE BEARINGS

mately 100 bearings can be babbitted in a day by one man.

All bearings which are babbitted are broached rather than bored, the same machine being used. The broacher is illustrated and consists of a reduced section piston with a shoulder and a threaded end. Over the end of the piston and down against the shoulder is placed a brass ring and then a heavy washer. Upon this is placed the broaching tool which is held firmly in position by a heavy nut. To broach the bearing the piston is lowered and the tool is pulled through, making the babbitt compact and free from air pockets and leaving the inside diameter correct.

Another jig of interest is that used for boring trolley harps. The harp is placed in the jig and held in position by a screw. The jig is placed on the drill press and one boring forms the trolley pole hole. The jig is then turned on its side and a second boring forms the trolley-axle hole in each arm. The jig is next reversed from its first position and the trolley axle cotter pin holes are drilled in two more operations. This jig is built of ⅞-in. mild steel and the holes are lined with tool steel bushings.

When the reclamation shop was first installed, it was thought that for some of the items handled in the shop a premium system of payment would be put into effect. This was tried out during the past year on welding and on the manufacture of various articles, but did not work out well and has since been abandoned. The total force in the reclamation shop now includes thirty-six persons, seven of whom are women, and two of whom are employed in the office. All of the women, with the exception of one office clerk, work in the armature room. They make coils, including the coils for air compressors, do banding on all kinds of armatures and rewind armatures.

At present there is adjoining the armature room a small electrically-heated bake-oven used for compressor-

TABLE II—TABULATION OF MATERIALS REPAIRED AND RECLAIMED DURING JULY, 1919

MATERIALS REPAIRED

No.	Description	Total Cost	Net Saving
3	Air armatures repaired	$40.82	$19.18
3	Air armatures repaired	9.47	20.53
3	Air armatures repaired	16.53	13.47
4	Air armatures repaired	32.03	7.97
1	Air armatures repaired	4.71	5.29
14	Air armatures rewound	304.88	255.12
1	Air armatures rewound	18.25	21.75
21	Air armatures rewound	422.78	417.22
1	Air armatures rewound	17.25	22.75
1	Air armatures rewound	20.05	19.95
6	Air armatures rewound	149.04	90.96
8	Air armatures rewound	141.17	178.83
1	Motor armatures repaired	31.06	8.94
19	Motor armatures repaired	135.14	149.86
2	Motor armatures repaired	18.75	11.25
14	Motor armatures repaired	97.81	112.19
2	Motor armatures repaired	14.66	15.34
1	Motor armature repaired	11.63	3.37
3	Motor armatures rewound	136.24	88.76
3	Motor armatures rewound	132.17	92.83
5	Motor armatures rewound	248.03	126.97
1	Motor armature rewound	65.00	15.00
8	Motor armatures rewound	773.99	226.01
6	Fare registers overhauled	5.73	9.27
8	Fare registers overhauled	18.44	21.56
3	Fare registers overhauled	4.72	2.78
3	Fare registers overhauled	2.07	5.43
5	Air compressors overhauled	217.57	157.43
1	Air compressor overhauled	66.42	8.58
6	Air compressors overhauled	264.20	185.80
3	Air compressors overhauled	109.37	70.63
3	Squires track magnets rewound	68.57	21.43
2	Squires track magnets rewound	24.57	15.43
1	Squires track magnet rewound	5.86	4.14
1	Squires track magnet rewound	13.62	6.38
1	Cont. switch box repaired	11.78	3.22
53	Field coils repaired	34.26	230.74
2	Field coils repaired	9.73	2.27
34	MS 46 switches repaired	51.23	118.77
2	Crank cases overhauled	59.78	10.22
1	Truck grinder repaired	5.66	1.84
1	Trolley base overhauled	6.61	3.39
1	G. E. Eng. valve overhauled	3.60	3.40
1	K6 controller repaired	26.05	8.95
1	Switch tongue repaired	3.70	1.30
2	Engine slide valves repaired	8.59	7.41
1	N. H. Squires Register overhauled	2.65	2.35
4	Wilson trolley catchers repaired	2.17	37.83
7	Wilson trolley catchers repaired	32.92	37.08
12	G. E. 80 armature bearings repaired	32.00	64.00
3	D coils rewound	12.07	11.93
2	Pit jacks repaired	25.38	4.62
1	Cheatham track magnet rewound	6.79	33.21
1	62-tooth gear repaired	3.62	14.38
1	Type K motor repaired	55.72	24.28
6	D coils rewound	27.10	12.90
5	D coils rewound	11.10	12.90
44	Fare registers overhauled	120.64	55.36
61	Fare registers overhauled	298.07	61.93
6	Pit jacks overhauled	77.94	72.06
20	Pos. journal bearings repaired	100.34	49.66
	Total	$4,762.10	$3,238.40

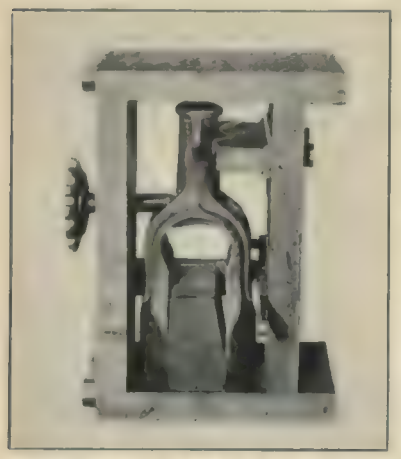
MATERIALS RECLAIMED

161	Half gear cases	$188.49	$2,548.51
3	Axles	41.78	78.22
1	Axle	21.04	18.96
6	Axles	93.87	146.13
4	Armatures	104.92	45.08
5	Armatures	23.62	51.38
1	Armature	12.62	12.38
1	Armature	6.16	18.84
1	Armature	2.64	22.36
1	Wilson trolley catcher	0.59	0.91
1	Bearing for coal elevator	1.33	3.67
4	Standard 0-50 equalizing bars	14.59	35.41
2	Standard 0-50 brake beams		
105	Standard journal housings	273.32	671.68
	Total	$784.97	$3,653 53

motor armatures and coils. Plans are being prepared, however, to extend the armature room on out over the receiving room and to install a dipping tank and large electrically-heated baking oven which will accommodate thirty-six armatures at once. The tank will be placed in the floor and reached by a trap door.

CAREFUL COST RECORDS ARE KEPT OF ALL WORK

The procedure of handling equipment which comes into the shop for repair insures that a careful record is kept of the piece until it is again returned to the division, and makes possible accurate cost records of repair work. As an example of how this is accomplished, consider a simple piece of equipment such as an armature. When this is placed on the supply car at the division point it is accompanied by a "Shipped by Supply Car to Reclamation Shop" order, in duplicate.



WITH ONE SETTING OF THE TROLLEY HARP IN THIS JIG ALL HOLES ARE DRILLED BY CHANGING THE POSITION OF THE JIG

Everything coming into the reclamation shop is received at the store room. Here the armature receives a tag to which in turn is attached a small tin disc bearing a number. This number follows the article through the shop and against it is charged the cost of the work. At the same time the armature is tagged, a shop order is made up in four copies, one being sent to the master mechanic's office together with a copy of the "Shipped by Supply Car to Reclamation Shop" order. One copy of the shop order is retained by the stockroom accountant, one by the storeroom and the fourth is sent to the foreman performing the work.

When the master mechanic's office receives the shop order, a "Foreman's Requisition for Material" order is filled out for the necessary material to perform the repair work. When the job is completed, the foreman fills out a form describing the work which was done and the materials used in the job. This form also shows credits which should be deducted for scrap salvage. There is also for this purpose a separate form which the foreman fills out and sends to the storekeeper, covering not only the scrap salvage but any unused material.

When the equipment is repaired and ready to go out to the division, a shipping order is made up in four copies, two of these go with the piece of equipment and two are retained in the master mechanic's office. One of those which accompanies the piece of equipment out of the shop is signed by the individual receiving it at the division point and later returned to the master mechanic's office. From the employee's time slip and the credit and charge forms the cost data are made up and recorded on the reclamation shop "Cost Card." All of the various forms mentioned above are reproduced in an accompanying illustration.

Some of the results actually attained at the reclamation shop should be of interest. During the year 1919 the estimated monthly savings in welding and repair the year are estimated at $86,442. An example of the work done and savings accomplished during a representative month is given in the tabulation of the report of materials repaired and reclaimed as shown in Table II.

Electric Lighting of Railroad Signals Discussed

Illuminating Engineering Society Takes Up Theory and Development of Electrically-Lighted Signals

AT A meeting held on March 11, 1920, one of the subjects discussed by the New York section of the Illuminating Engineering Society was "The Electric Lighting of Railroad Signals." L. C. Porter, Edison Lamp Works of the General Electric Company, and F. S. Stallknecht, Thomas A. Edison, Inc., Primary Battery Division, presented the subject. An abstract of the discussion follows:

Along some sections of railroads, electrically lighted lamps have been operated from local power circuits and in remote cases gravity and storage batteries have been used as the source of energy. In the majority of cases, however, the caustic soda primary cell is rapidly coming into general use for this purpose.

It is believed that the one factor which has done most to hasten the installation of electrically-lighted signal lamps is the increasing cost of labor. The electric lamp practically eliminates this item and also eliminates the frequent failures which occur with oil lamps. The electrically-lighted signal lamp has a higher cost of initial installation, but the cost of maintenance is considerably lower.

The fundamental principles of projection were explained in some detail by the assistance of slides and exhibits of the various types of lamps experimented with. The adapter blocks and focusing devices developed and the equipment now in most general use were also illustrated. The filament finally decided upon as a result of exhaustive tests was the C-2 form. This type gives a high beam candle power, a good spread, and is easy to locate at the focal point. Also as a result of the tests a G-12 bulb double-contact bayonet base with a 1¼-in. light center length was determined upon as the standard.

It is believed that the lamp should be renewed every time the battery is renewed, thus preventing interruption of service through lamp failures, and it is estimated that the batteries and lamps will need attention under average railroad service not more frequently than twice a year.

The interesting devices developed from the use of electric signal lamps have been the adapter block and the focusing device. By means of these the maximum efficiency of the low-voltage incandescent lamp is utilized and the focusing of lamps is placed on a basis which is so certain as to be almost mechanical. It is anticipated that the majority of initial installations in railroad work will be converted oil lanterns, but as these wear out and have to be replaced, it is assumed that the reflector type of lantern will be installed.

What is said to be the largest jet condenser yet built was recently completed by the Westinghouse Electric & Manufacturing Company, for the Alabama Power Company. It is capable of passing 13,000,000 lb. of water per hour.

Keeping the Overhead System Fit

Systematic Inspection and Careful Analysis of Failures Tends to Reduce the Latter, Not Only by Eliminating a Defect Before It Proves Serious, But by the Use of More Suitable Equipment Where Failures Persist







ONE TYPE OF TOWER LINE CAR USED BY CONNECTICUT COMPANY

THE work of maintaining the trolley and low-voltage lines of an electric railway property, being not more radically unique than that of other departments, depends to a certain extent upon the inherent conditions of the particular locality and property. Routine maintenance practice, however, need not differ in any important respect on various properties where even approximately similar conditions exist. In this article the results of a study of overhead maintenance practice of the Connecticut Company is given to illustrate the ways in which progressive companies are endeavoring to keep their lines in good form. This company operates approximately 700 miles of track in Connecticut, serving most of the cities and towns, both large and small, in that state. The railway system includes eleven divisions, and each of the overhead division forces takes care of its own construction, inspection and maintenance under general supervision of P. W. Ripple, chief engineer of power and equipment, and H. M. Gould, who is supervisor of lines of the company.

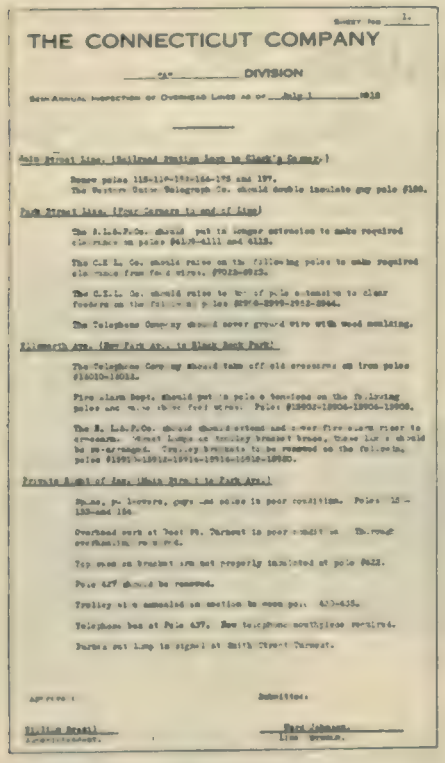
The line work in each of the eleven divisions comes under the direct supervision of a line foreman, with the necessary force of linemen, groundmen, etc., the number of men depending upon the size of the division. Table I shows the approximate mileage of each division, average number of men employed on the overhead work and the tower truck, car or wagon equipment in operation. This table would be misleading without the added information that these men look after the high-tension system as well as the trolley and low-voltage lines. It is impossible, therefore, to make any clear division of duties, and assign a definite number of men to the low-voltage work. The Hartford, New Haven and Middletown divisions all include some miles of high-tension lines.

In further explanation of Table I it should be stated that the Hartford, Middletown and New Haven divisions, which, as already noted, include high-tension lines, each have one man patrol these lines one day a week. The tower trucks in use at New Haven, Waterbury, Bridgeport and Hartford are Pierce-Arrow cars which are used mainly for emergency construction and maintenance. Ford runabouts are used by the signal maintainers.



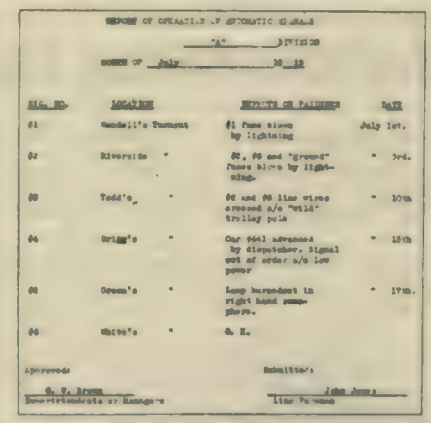
ONE TYPE OF TOWER LINE CAR USED BY CONNECTICUT COMPANY

Through the passage by the Public Utilities Commission of Connecticut of so-called Docket No. 1447 Order D, approving and establishing rules and specifications governing the construction and use of joint wood-pole lines, an inspection and report is made to the commission on Oct. 1 and April 1 each year. At these times complete inspections are made of the high-tension trolley and low-voltage system, and a detailed report of all defects found is made on the form shown in an accompanying illustration. The regular crew on each division makes the semi-



THE CONNECTICUT COMPANY

"A" DIVISION



REPORT OF OPERATION OF AUTOMATIC SIGNALS

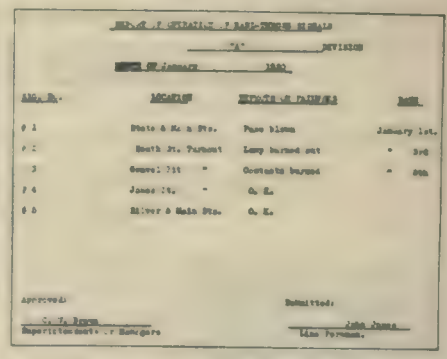
"A" DIVISION

MONTH OF July 19 18

SIG. NO.	LOCATION	DEFECTS OR FAILURES	DATE
#1	Gandell's Turnout	#1 fuse blown by lightning	July 1st.
#2	Riverside "	#2, #6 and "ground" fuses blown by lightning.	" 3rd.
#3	Todd's "	#4 and #6 line wires crossed a/c "wild" trolley pole	" 10th.
#4	Grimm's "	Car #641 advanced by dispatcher. Signal went of order a/c low power	" 15th.
#5	Brown's "	Lamp burnedout in right hand compartment.	" 17th.
#6	White's "	O. K.	

Approved: G. F. Brown, Superintendents or Managers

Submitted: John Jones, Line Foreman



REPORT OF OPERATION OF HAND-THROWN SIGNALS

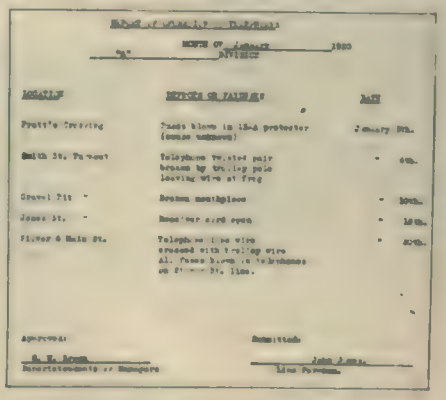
"A" DIVISION

MONTH OF January 1920

SIG. NO.	LOCATION	DEFECTS OR FAILURES	DATE
# 1	State & Main Sts.	Fuse blown	January 1st.
# 2	South St. Turnout	Lamp burned out	" 3rd
3	Gravel Pit "	Contacts burned	" 8th
# 4	Jones St. "	O. K.	
# 5	River & Main Sts.	O. K.	

Approved: G. F. Brown, Superintendents or Managers

Submitted: John Jones, Line Foreman.



REPORT OF MONTHLY INSPECTION

MONTH OF January 1920

"A" DIVISION

LOCATION	DEFECTS OR FAILURES	DATE
Pratt's Crossing	Fuses blown in 13-A protector (Cause unknown)	January 5th.
South St. Turnout	Telephone twisted pole because by trolley pole leaving wire at frog	" 6th.
Gravel Pit "	Broken insulators	" 10th.
Jones St. "	Receiver cord worn	" 15th.
River & Main St.	Telephone line wire crossed with trolley wire Al. fuses blown on telephones on Street St. line.	" 20th.

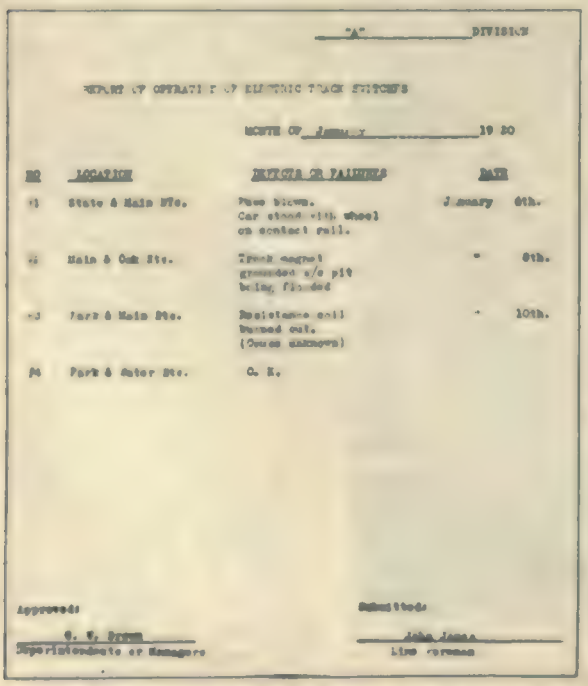
Approved: G. F. Brown, Superintendents or Managers

Submitted: John Jones, Line Foreman.

AT LEFT, SAMPLE OF REPORT ON SEMI-ANNUAL INSPECTION. ABOVE AND AT RIGHT, TYPE OF MONTHLY REPORTS MADE ON INSPECTION OF AUTOMATIC SIGNALS, HAND-THROWN SIGNALS AND TELEPHONES

annual inspection for that division. As many men as necessary are used to complete the inspection quickly. Each man is assigned to a definite portion of the system and proceeds on foot and inspects all parts, including poles, trolleys, feeders, etc.

If from the observation point on the ground the trolley wire appears badly worn or otherwise defective, the location is recorded and a tower inspection is later made. No maintenance work is done at the time of the inspection unless a dangerous condition which needs immediate attention is found. If the condition is dangerous but does not need immediate attention, the superior officer is notified and a separate crew is sent to handle the repair work. The reporting of defects pertaining to insulators, brackets, poles or feeders is simplified by the fact that each pole is stenciled with a number and the name of the company. On poles used jointly by several utility companies, which is common in the State of Connecticut, one company is appointed custodian of that pole, and the name of that company only appears on the pole. To avoid any confusion or misunderstanding as to responsibility, a standard form of contract has been adopted for pole-line agreements. On rural lines it is the general practice to stencil and number every fifth pole. On poles jointly used by other companies defects in the lines of any of these companies are called to the attention of that company, following the inspection.



"A" DIVISION

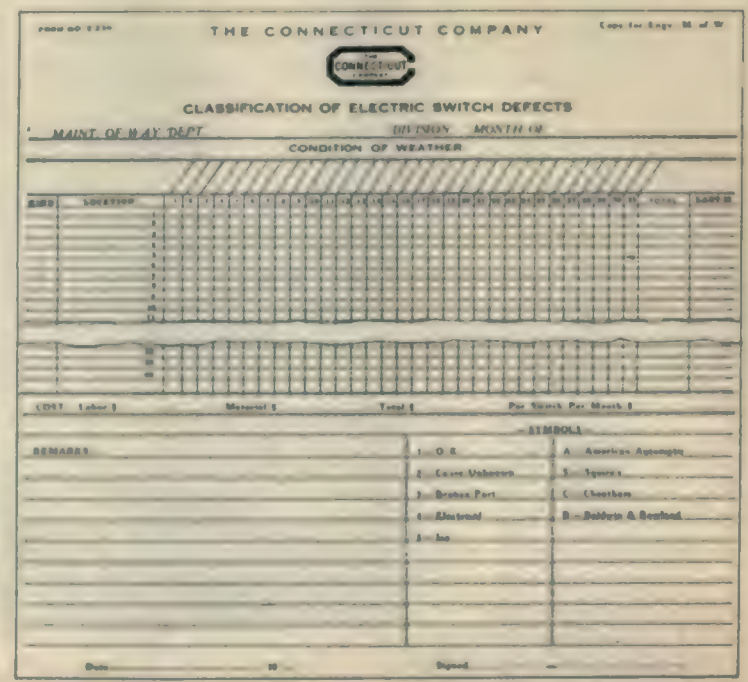
REPORT OF OPERATION OF ELECTRIC TRACK SWITCHES

MONTH OF January 1920

NO	LOCATION	DEFECTS OR FAILURES	DATE
#1	State & Main Sts.	Fuse blown. Car stood with wheel on contact rail.	January 6th.
#2	Main & Oak Sts.	Track ground grounded a/c pig being, flooded	" 8th.
#3	Park & Main Sts.	Resistance coil burned out. (Cause unknown)	" 10th.
#4	Park & Outer Sts.	O. K.	

Approved: G. F. Brown, Superintendents or Managers

Submitted: John Jones, Line Foreman



THE CONNECTICUT COMPANY

CLASSIFICATION OF ELECTRIC SWITCH DEFECTS

MAINT. OF WAY DEPT. DIVISION MONTH OF

CONDITION OF WEATHER

SYMBOLS

REMARKS

TWO MONTHLY REPORTS ARE MADE ON THE OPERATION AND INSPECTION OF ELECTRIC TRACK SWITCHES

TABLE I—MILEAGE, PERSONNEL AND EQUIPMENT OF OVERHEAD DIVISIONS

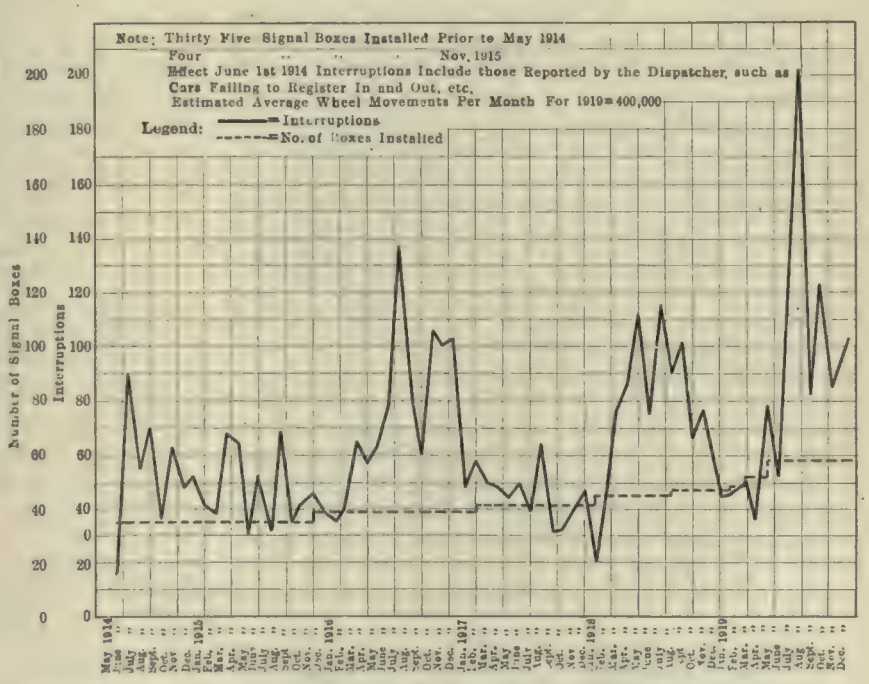
Division	Track Miles	Number of Men	Equipment
Stamford	23	1 Foreman 3 Men	1 tower wagon
*Hartford	183	1 Gen. Foreman 3 Gang Foremen 1 Sub-Foreman 1 Maintainer 15 Men	1 tower truck 2 line cars 1 tower wagon (seldom used)
*New Haven	151	1 Gen. Foreman 3 Gang Foremen 1 Emergency Foreman 5 Emergency Men 1 Signal Maintainer 21 Linemen, Groundmen, and Teamsters	1 tower truck 4 line cars 2 tower wagons
Bridgeport	101	1 Gen. Foreman 3 Line Foremen 1 Maintainer 15 Men	1 tower truck 1 Ford runabout 2 line cars 2 tower wagons (seldom used)
Waterbury	82	1 Gen. Foreman 3 Gang Foremen 2 Maintainers 13 Men	1 tower truck 3 line cars 1 tower wagon (seldom used)
Derby	25	1 Foreman 4 Men	1 line car
Meriden	38	1 Foreman 5 Men	1 line car 1 tower wagon (seldom used)
*Middletown	35	1 Gen. Foreman 2 sub-foremen 5 Men	1 line car 1 Ford runabout
New Britain	41	1 Foreman 6 Men	1 line car 1 tower wagon (seldom used)
Torrington	13	1 Man	1 line car

*This division includes also high tension lines.

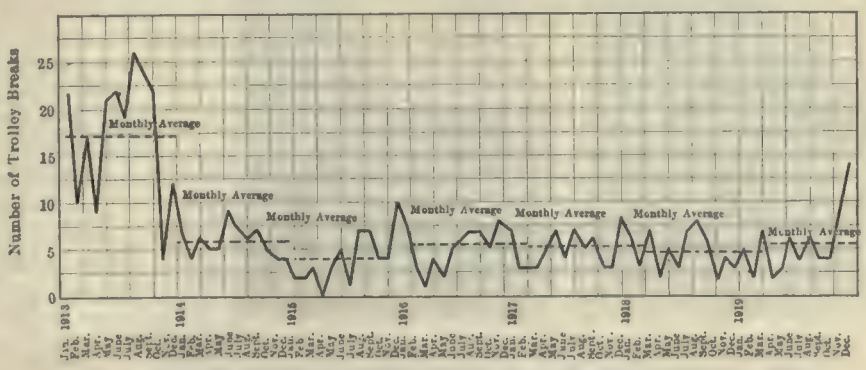
The report of the inspection, the form of which has been previously referred to, is made up in six copies. One of these is retained by the local foreman, one by the local manager and four are sent to the supervisor of lines. Two of these latter are sent to the Public Utilities Commission and two are kept in the office at New Haven. The copy of the report retained by the local foreman is used as a guide to assist him in planning his routine maintenance work. The holders of other copies of this report can check up at any time to ascertain whether the defects reported have been corrected. In the matter of routine maintenance, the crews recorded in Table I include in their regular work the duty of maintaining signals, telephones, electric track switches, etc. The New Haven division has, in addition to the regular repair and maintenance gangs, an emergency force consisting of a foreman and five men, three of whom are on duty at all times. They alone utilize the Pierce-Arrow tower truck. At Hartford, Waterbury and Bridgeport, one crew is detailed to handle construction, maintenance and emergency work on the city lines only. The four main divisions, namely, Hartford, New Haven, Bridgeport and Waterbury, each have a special signal maintainer who devotes his time to signals, electric track switches, lamp clusters, etc.

In addition to the semi-annual inspection each division is equipped with spare signal contactors and spare signal relays and is expected to replace three or four of each of these every month whether any defects are apparent or not. This method is believed greatly to reduce the number of emergency calls. At least once a month every signal box is inspected, the dust is blown out with a hand bellows, contacts are cleaned, etc. Thus, at least once every month a superficial inspection is made of all automatic signals, hand-thrown signals, electric track switches and telephones.

The type of monthly reports made on the inspections noted above is made clear by accompanying illustrations. On the automatic signals the report includes defects and interruptions reported by the dispatcher as well as those detected on special calls and in routine inspection. Where it is reported that a wrong light is displayed by a car passing in or out of a signal block, this may be due to the overhead frog being out of line, but more often it is caused by the improper operation of the car through the switch, and upon inspection the signal is found "O.K."



CURVE SHOWING NUMBER OF AUTOMATIC SIGNAL INTERRUPTIONS ON THE WATERBURY DIVISION OF THE CONNECTICUT COMPANY



GRAPH SHOWING NUMBER OF TROLLEY BREAKS ON BRIDGEPORT DIVISION OF CONNECTICUT COMPANY

TABLE II—TABULATIONS OF REASONS FOR INTERRUPTIONS TO AUTO

No.	Type of Interruptions	1914 May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1915 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1916 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	Fuses blown by lightning	1	17	4	23	...	10	6	...	...	...	..	..	2	7	5	35	14	..	..	..	...	...	7	1	3	47	19	2	
2	Fuses blown—cause unknown	...	...	1	...	...	...	...	...	...	...	..	..	1	.	...	1	...	1	1	..	2	..	..	1	..	2	1	1	..
3	Cars failing to clear signals, i. e., trolley wheel left wire at frog, or contactor failed to function, etc	No report										60	49	23	39	21	26	16	31	39	29	30	34	23	36	56	69	83	54	55
4	Cars failing to get signal, i. e., contactor failed to function, etc	2	...	..	..	..	..	..	...	2	.	1	1	...	1	...	...	1	1	1	..	...	..	..	..	..	..	..	..	2
5	Low-line voltage	...	...	..	..	..	..	..	..	..	..	..	..	..	..	.	..	...	..	..	..	...	..	35	..	..	..	..	1	..
6	Broken signal linewires	...	...	..	..	..	..	..	..	..	..	..	..	..	..	...	...	...	..	..	..	...	..	..	..	..	..	2	..	1
7	Broken signal contactor line wire	5	3	.	...	3	.	..	1	...	1	2	4	..	.	2	1	...	1	..	..	1	..	..	1	..	..	2	..	
8	Contactor sticking	...	...	..	..	..	..	..	..	..	..	..	..	1	.	1	1	...	..	..	..	...	..	..	..	..	..	..	..	..
9	Broken springs in signal contactors	4	1	..	1	1	1	.	1	.	.	1	..	...	3	...	3	...	1	..	..	...	..	..	..	..	..	..	..	..
10	Broken and burned contact fingers in signal contactors	.	4	2	1	.	.	1	2	.	...	.	1	..	..	...	..	...	1	..	.	...	..	..	..	..	..	..	..	..
11	Other broken and burned parts in signal contactors	.	..	..	...	...	..	..	..	..	..	..	..	...	..	..	...	..	..	..	..	...	..	1	..	..	..	..	..	..
12	Signal contactors clogged with snow and ice	.	.	.	.	.	.	.	.	.	.	.	4	...	.	.	.	...	.	..	41	...	3	1	..	..	..	..	..	..
13	Signal lamps burned out	.	...	.	...	..	.	.	.	.	.	.	1	...	.	.	.	1	.	..	1	...	..	1	..	1	1	1	..	..
14	Resistance tubes burned out	.	.	.	.	.	.	.	.	1	...	.	.	.	.	.	.	.	.	.	2	...	..	..	..	.	.	.	.	.
15	Relays open circuited	.	2	..	5	1	1	.	.	...	.	..	..	1	1	2	2	1	..	1	..	...	..	..	..	..	3	1	1	
16	Minor defects, i. e., loose screws, nuts, etc., in signal box	.	.	.	.	.	.	.	.	.	.	..	3	...	1	..	.	.	.	.	.	.	1	1	2		..			
17	Broken signal boxes, broken lenses, etc	1	.	.	.	.	.	.	.	.	.	1	..	.	1	...	.	.	.	.	.	...	.	.	.	.	.	1	..	
18	Line wires grounded thru lightning arresters	.	.	.	.	.	.	.	.	.	.	..	.	...	1	...	.	2	1	1	2	...	..	.	2	..	..	..	..	..
19	Signal line wires crossed	.	.	.	.	.	.	.	.	.	.	..	.	..	.	..	.	.	.	..	..	..	..	2	4	..	..	..	..	..
20	Simultaneous action, i. e., cars at opposite ends of block operating setting contactor at same instant	.	.	.	.	.	.	1	..	...	...	3	..	...	..	...	..	...	3	1	1	1	2	2	3	5	..	..	2	..
21	Signals inoperative on account of linemen working on same, etc	...	...	.	....	...	....	....	....	...	...	..	1	1	1	...	...	...	2	..	..	...	..	..	..	..	..	1	..	..
22	Total per month	13	27	7	30	5	12	8	4	3	1	68	64	29	55	31	69	36	42	44	39	34	40	66	56	63	78	37	80	60
23	Average per box per mo	0 37	0 77	0 2	0 85	0 14	0 34	0 23	0 11	0 08	0 03	2	1.9	0.83	1.6	0 91	2.03	1 05	1 1	1.1	...	0.87	1 1	7 1	4 1	6	2	3.5	2	1.5

The monthly report made on the operation of hand-thrown signals shows blown fuses, burnt-out lamps, etc. If reports indicate that this trouble is habitual with any particular switch, a further investigation is made to ascertain the real cause of the trouble. In the maintenance of electric track-switches there is necessarily a division of responsibility between the overhead and track departments. In order to eliminate the possibility of a tendency to avoid the responsibility relative to the real cause of a defect reported, it is now arranged so that both the line foreman and the roadmaster make reports on electric track-switches. A sample of each of these reports is reproduced, and special attention is called to the report made by the way department. This is made up in five copies, each on a sheet of different color. One is sent to the engineer of maintenance of way, one to the local manager, one to the supervisor of lines, one to the local line foreman and the fifth is retained by the roadmaster. In this way every one concerned with operating electric switches is conversant with all defects and the steps of rectification.

As it is of the greatest importance that automatic signals, to insure correct operation, be maintained in the best condition possible, a careful study is made of the monthly report on this type of equipment. From the automatic signal report a special graph has been prepared showing the interruptions since May, 1914, for the Waterbury division. The term "interruptions" includes not only the defects found by the line department, but also defects reported by the dispatcher and often found to be groundless.



TYPICAL TELEPHONE INSTALLATION ON CONNECTICUT SYSTEM



TYPICAL SIGNAL INSTALLATION ON CONNECTICUT SYSTEM

TABLE III—TABULATION OF REASONS FOR TROLLEY BREAKS ON BRIDGEPORT DIVISION AS ILLUSTRATED.

Causes of Breaks	1913	1914	1915	1916	1917	1918	1919	Grand Total
Breaks at soldered sleeves	63	10	1					74
Breaks at end of cut-outs	13	1	1					15
Breaks from wild trolley poles	42	7	8	26	31	32	21	167
Breaks from natural causes (poor wire)	57	9	6	10	8	12	15	117
Breaks at end of safety over cut-out	1		1		..	..	.	2
Breaks from grounds and electric light wires	..	6	3	10	1	..	..	[illegible]
Breaks at end or middle of soldered ears	28	8	3	2	7	2	6	56
Breaks at end or middle of mechanical ears	..	9	3	.	4	.	6	22
Breaks at end of bridge pan	..	1					1	2
Breaks at point of bend on splicing ears	3						..	3
Breaks at strain ears	1	1	1				.	3
Breaks from falling trees	..	2		1	2	1	..	6
Breaks from truck pulling wire down	..	1				..	..	1
Breaks from cars backing up	..	2			3	..	2	7
Breaks from pulling out of K & I sleeves	..	8	2	..	1	.	..	11
Breaks at Clark splicers	..	1						1
Breaks from pulling out of Cleveland splicer, chucks were too small	..	2	1					3
Breaks from breaking of flexible steel cable on Congress St. Bridge		1				1	..	2
Breaks from wire being burned down on account of sleet	..		7		.	2	..	9
Breaks from wire being burned down by grounding on Railroad Viaducts	..		4	6	3	2	.	15
Breaks from O. B. S. Beam Section Insulator pulling apart	..		6	1	..	..	1	8
Breaks from Cleveland splicer breaking in two	..		1	2	..	..	6	9
Breaks from wire burnt down by steam shovel	..		.	3	2	4	..	9
Breaks from Macallen section ins. pulled apart	..		.	1	1	..	..	2
Breaks caused by advertising banners	..		.	.	..	..	1	1
Breaks defective hangers	.		.	.	..	..	1	1
Breaks at end of Cleveland splicer							1	1
End of Strain Anchor Plate							2	2
End in loss of Cleveland splicer							2	2
Total	208	69	41	62	63	56	65	Grand Total 571

ALS ON WATERBURY DIVISION AS ILLUSTRATED

	1917												1918												1919												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
	..	..	..	..	6	8	11	24	...	3	...	..	...	..	2	..	30	1	40	32	..	..	1	..	...	...	...	...	8	8	17	3	9	8	..	...	424
	1	..	..	..	..	..	...	..	...	...	...	..	...	..	...	1	..	1	4	2	1	3	3	..	...	...	3	1	..	...	2	..	1	1	3	1	41
	46	53	48	47	38	35	28	25	28	27	35	28	7	42	70	80	74	64	56	50	77	33	28	25	28	45	31	26	66	31	74	177	56	101	74	84	2,894
	..	2	..	..	..	..	...	..	...	...	...	..	...	..	...	..	..	..	..	..	..	..	..	1	...	...	...	...	..	...	..	1	2	1	..	...	23
	..	1	1	..	..	2	...	1	...	...	1	2	...	1	..	1	2	..	2	..	13	..	2	10	7	...	1	3	..	...	21	7	...	1	..	2	111
	..	..	..	1	..	..	...	..	1	...	1	1	...	..	1	..	..	1	1	1	1	5	5	1	4	...	3	1	..	...	1	2	1	1	..	1	61
	..	..	..	..	1	..	...	..	...	...	1	1	1	..	1	..	..	1	..	..	1	..	..	..	...	...	...	...	..	...	..	..	...	...	..	...	25
	..	..	..	..	..	..	...	..	1	1	1	1	...	..	...	..	..	..	..	..	..	..	..	..	...	...	...	...	..	...	..	..	...	...	..	...	21
	..	..	..	..	..	..	...	..	...	...	...	1	1	2	...	3	5	..	3	5	7	2	6	4	...	1	1	...	4	1	2	6	6	4	1	5	72
	..	..	..	..	..	..	...	..	...	...	1	9	...	..	...	..	..	..	..	..	..	..	1	..	...	...	5	...	..	...	..	..	...	...	..	...	30
	1	..	..	..	..	..	...	..	...	...	...	..	...	..	1	..	..	..	..	..	2	2	1	1	...	...	...	...	..	1	1	..	...	...	..	...	18
	..	1	..	..	..	1	...	3	...	1	...	..	...	1	...	..	2	..	..	5	..	..	1	..	...	...	1	2	..	...	1	1	...	2	..	1	48
	..	..	..	..	..	2	...	..	1	...	...	..	...	..	...	..	..	..	..	1	..	1	1	..	...	...	...	...	..	...	..	..	...	...	..	...	14
	..	1	1	..	..	..	...	..	...	...	...	..	...	..	...	1	..	1	..	..	..	..	..	..	...	...	...	...	..	...	..	..	...	. .	..	...	8
	..	..	..	..	..	1	...	1	...	...	...	..	...	..	...	..	..	..	6	..	..	1	..	..	...	...	...	...	..	...	..	1	...	2	1	2	25
	..	..	..	..	..	..	...	..	...	...	...	..	...	..	...	..	..	..	..	..	..	3	9	1	...	...	1	...	..	...	2	1	...	...	1	...	25
	..	..	..	..	..	..	...	..	...	...	...	..	...	..	...	1	..	..	2	3	..	4	..	..	...	...	...	...	..	...	..	..	...	...	..	1	43
	..	..	..	..	..	..	...	..	...	...	...	..	...	..	...	..	..	..	..	6	..	12	4	25	4	...	3	...	..	...	..	..	...	1	..	...	61
	48	58	50	48	45	49	39	64	31	32	40	46	21	44	76	88	113	74	114	91	102	68	76	60	45	46	50	37	78	43	124	203	83	123	86	103	4,003
	1.1	1.4	1.2	1.2	1.1	1.2	0.95	1.6	0.75	0.70	0.93	1.1	0.49	1	1.75	1	8	2.5	1.6	2.5	2	2.2	1.5	1.6	1.3	0.96	0.98	0.89	0.66	1.4	0.77	2.2	3.5	1.43	2.12	1.5	1.78

Among other things this graph illustrates that during the months of July and August, when the heaviest lightning disturbances occur, the number of signal interruptions reaches the maximum. This period during 1919 seems to have been particularly severe. This graph is of maximum value when considered in connection with the number of operations of the signals in a given period. The approximate number of wheel movements per month through all signals on the Waterbury division for the year 1919 was 400,000.

To supplement the graph a table is made up showing the causes of all interruptions. (See Table II.) It will be noted from Table II that more than 70 per cent of the interruptions were due to cars failing to clear the signals. This in many cases is due to improper operation of the signal contactor, to the trolley wheel leaving the wire at the frog or to some other cause which is not the fault of the signal. Another 10 per cent of the interruptions are due to lightning. At the peak recorded in the month of August, 1919, out of 203 interruptions, 177 were due to the first cause discussed above and only 3 per cent to lightning. Thus the graph alone would be misleading without an accompanying analysis. Normally, the peaks during July and August have been caused by lightning interruptions. Considering 40,000 wheel operations as the limit of possible failures, the number of interruptions in the worst month, namely, August, 1919, was ½ per cent, while in the best month of that year the number of interruptions was only 0.09 per cent.

Another graph of interest which has been made up by the Connecticut Company is that reproduced in an accompanying illustration showing the number of trolley wire breaks on the Bridgeport division since Jan. 1, 1913. This graph shows clearly that during the first ten months of 1913 the number of breaks was exceptionally high, and it was found that the largest percentage of these were due to breaks at the end of soldered sleeves. This type of sleeve was eliminated and the Cleveland splicer was substituted. A large number of the breaks which occurred during 1913 were also due to poor wire and "wild" trolley poles.

Electric Rivet Heaters Prove Efficient

A NEW electric rivet heater has been placed on the market by the General Electric Company, Schenectady, N. Y., which has proved both efficient and economical and gives promise of superseding the coke forge and the oil-burning furnace for rivet heating. The machine is shown in the accompanying illustration and at the first glance gives one the impression of a portrait camera ready for action. The rivets to be heated are placed between two electrodes and complete the circuit. These electrodes can be operated separately by the use of pedals, so that the man operating the machine can take out a heated rivet from one side, replace it with another to be heated and then shift to the other side for the next heated rivet. A switch on the back of the machine gives the variations of current needed in heating rivets of different sizes. The machine as constructed is capable of heating 800 rivets per hour, which is believed to be the maximum number an operator can handle.



FRONT VIEW OF ELECTRIC RIVET HEATERS

Some of the advantages claimed for electric rivet heating are saving in time, reduction in danger of burning, and no smoke, ashes or gas to inconvenience the workers.

Richard Sachse, chief engineer Railroad Commission of the State of California, states that great interest has been manifested in England, France, Germany, Sweden and Japan in the report of inductive interference, which was reviewed in the issue of this paper for Feb. 28, page 455.

Signaling the Approach of Cars for Connection

A Description of Equipment as Developed to Signal Main-Line Cars When a Branch-Line Car Is Approaching to Make Connection

BY HARRY RESTOFSKI

West Penn Railways, Connellsville, Pa.

THERE is a branch line a little over two miles in length on our line on which one car makes a round trip every half hour. This branch connects with the main line a short distance from a waiting room, as shown in an accompanying diagram. The branch line car is due at the waiting room on the hour and half hour, at which time main line cars pass others at the siding located at this point.

Prior to the installation of the signal described herewith, there was no way of knowing how late branch-line cars might be. For this reason it became the practice of crews not to delay main-line cars in order to wait for the branch-line cars to make the connection. At times the branch-line car would arrive immediately after the departure of the main-line cars, so that it would then be necessary for passengers to wait a half hour in order to make connection.

The equipment shown in a second illustration was installed to remedy this condition. Two directional contactors were attached to the trolley of the branch line. No. 1 contactor was located such a distance from the waiting room that the running time for the car from this point was two minutes. The other contactor was located at a point where the two lines join just below the waiting room. A battery box with relay equipment was located near contactor No. 2 and a signal box with red bull's-eye lenses was installed in front of the waiting room.

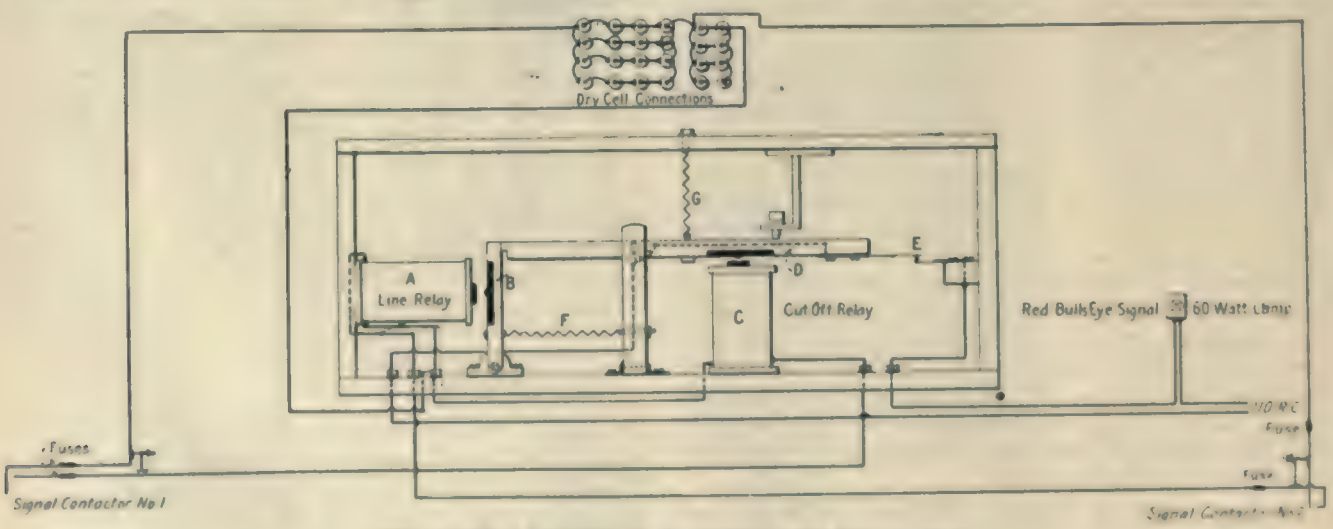
The equipment is automatic in its operation and the sequence of operations is as follows: The trolley wheel of an approaching branch-line car operates contactor No. 1, which causes the momentary closing of a circuit from the battery through relay C. Armature D is thus operated causing contact to be made at E, and thus supplies 110 volts alternating current to the 60-watt signal lamp located in the signal box. As soon as the armature D operates, a spring F pulls the armature B to the right and under the offset end of D so that the latter is held in place against the action of the spring G. The signal light continues to burn until the car reaches contactor No. 2, when a circuit is established through the relay A and a portion of the dry batteries. Relay A then attracts the armature B which allows the spring G to open the alternating-current contact at E and so interrupt the flow of current to the signal line.

The signal thus shows red when the branch-line car is within two minutes of the waiting room and if necessary main line cars are held that length of time.



LINE CONNECTION AND LOCATION OF SIGNAL APPARATUS.

The relays might have been operated from the trolley or with 110 volts alternating current, but it was decided to use dry cells as it was thought that less trouble would thus be experienced. Fewer cells are used in the circuit to No. 2 contactor than in the No. 1 contactor circuit because the former is closer to the relays and there is therefore less line loss. The battery as installed has a life of from six to eight months as current is used only at the instant that contact is made at one of the directional contactors. These contactors are a standard type built by the United States Signal Company. Fuses and grounded carbon blocks are used for the protection of the contactor circuit. This equipment has now been in use for nearly two years and has proved entirely satisfactory.



APPARATUS LOCATED IN BATTERY AND RELAY BOX.

A branch of the National Safety Council has been organized in Minneapolis with committees on finance, public safety, industrial safety, traffic, organization, schools and membership. It is planned to engage an expert safety engineer to take the lead in this work.

A. I. E. E. Holds Traction Meeting

The Papers at the Pittsburgh Meeting of March 12 Covered Substation Problems and the St. Paul Locomotive—They Were Abstracted in Last Week's Issue—The Discussion Is Abstracted in This Issue

ONE OF the best attended meetings of the American Institute of Electrical Engineers which has been held outside of New York City took place in Pittsburgh on Friday, March 12. The entire day was devoted to discussion of railway apparatus and equipment, including descriptions of the two designs of locomotive for the latest Chicago, Milwaukee & St. Paul electrification. The papers for this meeting were abstracted in the March 13 issue of this paper.

The morning was devoted to an inspection of the Westinghouse Electric & Manufacturing Company's works at East Pittsburgh, during which the visitors had opportunity to see one of the new automatic switchboards which are being built for operation in one of the Cleveland Railway's substations. The most interesting event of the morning, however, was the inspection of one of the ten St. Paul locomotives which the Westinghouse company is furnishing. After an interesting motion-picture exhibit of railway electrification, the Westinghouse company entertained the group at luncheon in the Women's Cafeteria. The afternoon session was devoted to two papers on short circuit and rotary flashing protection, and to two papers on automatic railway substations. The evening session, held after an informal evening dinner, was devoted to the discussion of the two designs of the St. Paul locomotive. Over 300 were seated at the dinner and nearly 500 attended the meetings.

> WE MUST LOOK at the subject of electrification broadly. Every heavy electrification so far installed has proved successful. No steam railroad operator who has an electrified section would consider reverting to steam. Electrical engineers must not becloud these facts in their discussion of types and details of locomotives. In the present instance, both locomotives will doubtless give satisfactory service on the St. Paul.
>
> CALVERT TOWNLEY
> President American Institute of Electrical Engineers

During the morning the board of directors held a meeting, at which, in addition to other matters considered, President Calvert Townley was authorized to appoint, after conference with W. S. Murray, a committee for the specific purpose of study and report on the super-power scheme for the Northeastern Atlantic Seaboard. It will be recalled that at a meeting of the Institute held in New York City on Feb. 20, a resolution was passed requesting the board to consider the advisability of appointing such a committee.

PROTECTION AGAINST FLASHING ANALYZED

In the discussion of the papers on "Short-Circuit Protection for Direct-Current Substations" by J. J. Linebaugh and on "Flashing of 60-Cycle Synchronous Converters and Some Suggested Remedies" by M. W. Smith at the afternoon session, F. D. Newbury made the point that a modern high-speed breaker is a greater potential danger than an ordinary breaker. Unless it clears the circuit before flashing occurs, it may cause flashing by its opening. If the circuit is not opened at all, there is less danger from flashing than if it is opened just after flashing occurs. That is, if on account of the high current there is sufficient gas generated to "short" the machine, then that "short" will continue even after the circuit is opened. Mr. Newbury also pointed out that the two papers do not agree as to the effectiveness of flash barriers as a protection against flashing. While perhaps the question is not finally answered now, it is hoped to find the answer of flash protection without the use of barriers, which form obstructions around the commutator and brush-holders. The high reluctance of the commutating pole is an improvement which will assist materially in the solution of this problem.

C. H. Jones, electrical engineer Chicago, North Shore & Milwaukee Railroad, quoted some interesting experiences with reference to flashing in its substations. From its experience, the new commutating-pole converters are apparently much more liable to flash than the older converters. Whether this is a bad effect accompanying better design in other ways, as compared with the older types of converters, or whether there is some other reason was not analyzed by Mr. Jones. He stated that he was merely presenting experience. New equipment has been installed with barriers and none of these rotaries have flashed. Sometimes the rotaries have been heard to "squeal" as though they were about to flash, but they have never done so. Two of the rotaries which had been installed without barriers flashed on occasion; since adding barriers there has been no record of a flash. The stresses imposed which have caused flashing, when flashing occurred, and "squealing," when flashing seemed imminent, have been as great as those involved in starting a four-car train in front of a substation, the train drawing 1,000 amp. per car at the start.

In closing the discussion on these papers the point was made that in order to prevent flashing by means of a high-speed breaker the circuit must be broken before one commutator bar can move from one brush to another, and this time element usually cannot exceed 0.008 sec. The General Electric Company experiments, in which a breaker was timed, included one test (which was verified by repetition) of breaking dead short circuit five times in seven seconds without any subsequent flashing. A high-speed breaker is particularly effective with a machine having high-reluctance commutating poles, and, if the development along this line is perfected, flash barriers may be done away with. A combination of a high-speed breaker, cutting in resistance, with a low-speed breaker which breaks the circuit completely somewhat later, has been used. However, the high-speed breaker upon operation, when it cuts in resistance, starts a cyclic variation on the alternating-

current side, and, if the low-speed breaker operates seven or eight cycles after this, the machine is still likely to flash due to the variations on the alternating-current side not having been damped. If, on the other hand, the low-speed breaker does not operate until seventeen or eighteen cycles, the operation is satisfactory.

AUTOMATIC SUBSTATIONS FAVORED

Much interest was evident in the discussion of "Automatic Railway Substations" by F. W. Peters, and "Automatic Substations for Heavy City Service" by R. J. Wensley. S. Q. Hayes related what seemed to him a coincidence, that only on the preceding day he had received information from Brown, Boveri & Company, that one automatic substation is now installed in Switzerland. This, however, is not automatic in the sense in which the term is used in this country, in that the station starts operation when the load approaches it, but rather that it starts and stops automatically by a clock arrangement, starting at a certain given time in the morning and stopping at a set time in the evening.

C. H. Jones stated that from the two and a half years' experience of his company the automatic substation is a success, at least in heavy interurban traction service, in fact, he feels that the automatic substation is more satisfactory than the manual. On this road there are five substations, three of 500-kw. capacity each, one of 300-kw., and one of 1,000-kw. All are 25-cycle, but one is being changed over to 60-cycle, and a new 60-cycle substation is on order. These five substations operate on an interurban system where 47-ton steel cars are used in from one to four-car trains. Mr. Jones emphasized, however, that an automatic substation cannot go forever without attention. It needs careful observation and maintenance, and he has found it necessary to make inspection once per day.

Mr. Jones made the additional point that he has found it desirable to know what the station has done between inspections. At the present time no recording instruments of any kind are furnished by the manufacturers to indicate what happens in the station between inspections. Manufacturers should provide some such equipment. In its absence he has installed Veeder counters on each piece of operating mechanism and, by checking up the number of times one piece operates against the number of times the others operate, some idea of the general action of the various pieces is obtained. But this is not sufficient.

Another speaker argued that the installation of automatic substations allows a road to carry over peaks with smaller installations on account of the inherent characteristic of intermittent operation. Continuous operation, even with low loads, keeps machine temperatures up, whereas intermittent operation, over the peak only, allows a greater peak load. Another feature is that the low trolley voltage, due to the inadequate system of distribution from manually operated stations, the number of which must be affected by the operator's wages, may be much improved by redistribution of substations on the automatic basis. As an inverse to the taking down of copper in Mr. Wensley's analysis, an automatic substation may prove its economy by savings realized by obviating the necessity for putting up copper. Many electric railways must also control auxiliary circuits, such as lighting, sometimes industrial power, and sometimes pumping, and this may also be done from the automatic substation. Another economic feature with reference to shut-downs due to labor strikes is that in many cases where some labor can be obtained, the main power house can operate and automatic substations will keep the system going, thus making a saving in preventing the loss of revenue which would occur through non-operation of the road.

Another speaker said that little had been said about high-tension switching. On interurban roads which are competitors of steam roads, continuity of service is of extreme importance. Where the road depends upon a long-distance high-tension supply line a steam station is usually kept in "hot standby" and, if the long-distance line falls, the steam station cuts in. Such interurban roads using automatic substations must then have duplicate lines with additional relays to cause automatic transfer from a disabled line to another line, so arranged that, when the disabled line is restored the station automatically returns to it. Another feature in the case of a "disconnect" due to overload is that a manual station's operator usually is told to make three trials to close the circuit, spacing these trials about a minute apart, and, if trouble still exists, to report to someone higher up. In automatic substations there must be something to take the place of this, and a motor-operated switch has been used to close the circuit three or four times at satisfactory intervals. Then, if trouble still exists, the switch is locked up and the dispatcher is automatically signaled.

FUTURE POSSIBILITIES OF THE AUTOMATIC SUBSTATION

Donald Bowman, Commonwealth Edison Company, raised a question in regard to the future possibility of the application of automatic substations to extremely heavy low-tension direct-current service. His question related to a system where the whole distribution plant is underground and the element of continuity of service is at least equivalent in importance to operating cost. In many substation operations it is satisfactory if everything is done as per schedule, but if on a large system a generating unit or a substation unit burns out, either of which seriously impairs continuity of service, then there must be emergency switching, both high-tension and low-tension. And in part the switching done must be developed by the needs of the moment and can hardly be scheduled in advance. Similar conditions arise when a manhole "blows out" or when some other heavy accident happens in the underground distribution system.

In closing the discussion on these two papers Mr. Peters stated he was in thorough agreement with Mr. Wensley on the analysis of concentrated city service. To be sure, most of the present installations are interurbans and there is no doubt as to the return on the investment in those cases. On the other hand, in heavy city service the equipment is not so cheap and the attraction to automatic stations in big centers must be based on an analysis such as Mr. Wensley has given and on more effective operation in general. If all engineers took the interest in automatic substations which Mr. Jones does they would be much better off. He said also that there are several automatic substations operating in Australia and one is now being shipped to New Zealand.

Mr. Peters said also that the application of automatic substations to industry has been urged, as these are

excellent in large factories. For example, in the case of an industrial plant having a long low-voltage distribution, the fixed charges on the actual investment in copper plus the heating losses will more than take care of the installation of small automatic substation units in the industrial establishment. One large manufactory is now installing several of these to replace its heavy low-voltage distribution.

Absolute Automatic Operation Improbable

Mr. Wensley first answered Mr. Bowman's question as to intensified low-voltage systems and stated that this was a real problem, perhaps the biggest problem in the application of automatic substations. There have already been developed as part of the standard product selective power relays to clear out from the tie bus feeders which are giving trouble. Power can be fed in through several buses from different directions and automatically relays can pick a satisfactory live bus. Many other operations like this can be performed. But, in Chicago, where there is one of the largest networks in the country, it will probably be impossible to make the whole system automatic. The system operator, however, might be enabled by some method of selection, such as is used in the automatic telephone system, to control individual switches in a substation and thus take care directly of the emergency switching.

On the other hand, the automatic substation has some inherent characteristics in the case of serious shutdowns which can never be equalled by the present manual method of operation. Reference here is made to a condition in which there is a complete, or very large partial, shut-down of service and in which service must be restored. Under manual operation, if the whole or a large part of the system is down it is frequently necessary to send out men to cut off individual buildings and large feeder sections, so that the load may be taken on a little at a time. Under the automatic system the feature of load-limiting resistance helps the system to come back gradually and pick up the entire load without any such universal disconnection. Mr. Wensley was willing almost to guarantee that an automatic substation system could pick up a full load within three minutes after power was supplied again, as compared with an estimated three hours under manual operation.

Of course the principle of load limiting resistance is not limited in its application to automatic substations, but it might be installed as an auxiliary to manual operation. However, the additional automatic features of the automatic substation are well worth while, for they tend to make the operation most rapid, in fact, some series of operations are completed in the same time that the station operator would be deciding as to which switch to throw first.

Referring to the necessity for applying high-speed circuit breakers to automatic substations, Mr. Wensley said that by the automatic introduction of three steps of resistance in cutting down a short circuit before opening up, the necessity for a high-speed circuit breaker is eliminated.

A Musical Treat at the Dinner

After the informal dinner in the evening, short addresses were made by E. H. Sniffin, manager of the power department of the Westinghouse Electric & Manufacturing Company, by A. W. Thompson, president of the Philadelphia company, which owns and operates the local electric light and power company, gas company and railways and by Calvert Townley, president of the Institute.

During the dinner the guests were very pleasantly entertained by a musical treat by Phillips Thomas of the Westinghouse Company. Mr. Thomas produced his music electrically. By means of a convenient keyboard mechanism he connected various values of inductance and capacity in a resonating circuit whose source of energy was a mercury vapor lamp and to a piano accompaniment played a large number of popular and even classical airs. A loud speaking transmitter served to make the music audible to all in the large dining hall.

Locomotive Discussion Lacks Excitement

At the evening session the two papers by A. F. Batchelder and S. T. Dodd of the General Electric Company and N. W. Storer of the Westinghouse company were presented in discussion of the two designs of locomotive for the Chicago, Milwaukee & St. Paul Railroad. Judged from the tenor of previous Institute meetings on matters having to do specifically with methods of trunk line electrification, the discussion at this meeting was, as Mr. Storer expressed it, exceedingly tame. None of the lively discussions between representatives of the two schools of thought developed, as might have been anticipated from earlier traction meetings.

Mr. Storer, after reading his paper, made the additional remark that it would be difficult to imagine two results or two locomotives differing more than these do and yet made to fill the same specifications. On the other hand, this very difference shows the flexibility of the application of electricity, not only to traction, but to industry in general.

R. L. Wilson, recalling his practical experience in the beginning of heavy electric traction on steam roads, said that the early impression was that the electric locomotive was so complicated as to be not readily accepted by steam railroad operators. It still appears to some railroad men to be a complicated piece of machinery, but its reliability has been proved. There is quite a divergence mechanically between these two locomotives. The Westinghouse locomotive is the well-known Pacific type, but what led to the other type is not apparent. It seems that the General Electric Company expected its locomotive to react on the track and that certain devices have been introduced to overcome this tendency. One of these is the use of rollers under the cab. On the New York, New Haven & Hartford locomotives a roller is used under the cab, but, while similar to the one now adopted on the St. Paul locomotive, it differs in that all rollers continue to bear weight, whereas there is a possible objection in this one in that the roller on one side rolls up an incline and is active, but the roller on the other side may be left without weight on it and thus prove a weak point.

The slow speed motor on the General Electric locomotive would naturally call for high copper losses. The question was raised as to the reasonableness of the amount of heat which would be produced in the motors on the long grade which these locomotives must negotiate on the St. Paul. Another question related to the temperature rating, the paper having given 266 hp. as the rating of the motor at 120 deg. temperature rise, but having said nothing as to the maximum operating temperature expected. Considerable stress having been laid upon the efficiency of the gearless motor at high speed,

the question was raised as to what would be the average speed at which these locomotives would operate.

Mr. Storer was asked as to possible contemplated difficulties with the exciter, which is mounted like an ordinary interurban motor. The point was brought out that this means a reversal of the ordinary drive between gear and pinion in this type of mounting, in that the usual drive is a small pinion driving a large gear, whereas in this case the large gear drives the small pinion. Mr. Storer's reply was that the size of the axle-driven generator was so much over the amount of power it would be called upon to give that no trouble with this was anticipated.

A. M. Candy, in discussing the complexity of the modern locomotive, related his experience in connection with the Pennsylvania electrification. In this case a man was placed on each locomotive to help the engineer in case of trouble and these men vied with each other in finding quick answers to hypothetical troubles and stayed up late at night familiarizing themselves with all the various details of the locomotive, but in no case was there any opportunity to test their ability. The complexity is apparently over-emphasized. Another speaker called attention to the fact that in comparing the electric locomotive with the steam, if every little detail of the steam engine from the chemistry of its coal to the final mechanics of its valve motion were taken into consideration, it might be found as complex in its way as the electric locomotive is in its own.

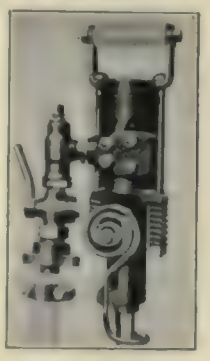
Success of Electrification Emphasized

President Townley emphasized the fact that the electrification of the steam road must be looked at broadly; that so far every electrification of a steam road had been successful; that, to be sure, these electrifications had all been with different types of locomotives, varying in design and efficiency, but that electrical engineers must emphasize the uniform success of electrification. No steam railroad operating man who has an electrified section would discard it now and replace it with steam. When electrical men argue too much about the types and locomotives, steam railroad operators may grow skeptical. What will probably happen in the present instance is that both of these locomotives will perform to the entire satisfaction of the Chicago, Milwaukee & St. Paul Railroad, and while electrical engineers may learn something from the comparison of the two designs for a given specification, the argument about these two designs should not be emphasized in such a way as to throw any doubt upon the intrinsic value of either. Electrifications now planned and to be executed in the near future will call for so many locomotives that all the facilities of all the manufacturers will not be enough to satisfy the demand.

In closing the discussion Mr. Dodd said that he did not know the temperature at which the motors would operate, but that he knew the motors would perform service and called attention to the successful operation of similar motors on the New York Central. As to complexity, he stated that if it were desired he could show diagrams much more complex than those showed by Mr. Storer but emphasized again the point made by Mr. Townley that the first thing to look toward is service. With reference to the center of gravity, he stated he did not see that it made much difference where it is, so long as the weight is properly distributed to make a locomotive ride the track satisfactorily. In this connection he called attention to a previous discussion of this point by Mr. A. F. Batchelder before the American Society of Mechanical Engineers at its annual meeting in December, 1916.

He brought up another point of Mr. Townley's that there is a big job ahead in electrification and it is splendid to have these two designs upon which to base further developments. At the present time there are about 350 heavy traction electric locomotives and about 68,000 steam locomotives, so that the work of electrification is just beginning and there is much to work out before electricity comes into its own.

Mr. Storer said he was sorry the meeting had been so tame. He said he tried to start a few things but could not get any reaction. He did emphasize that he was very glad that the two companies were both working on the same job, that both locomotives would probably perform good service for the railroad, and that, as a result of the divergent designs, the whole art would benefit from the results of the study of the service of the two locomotives.



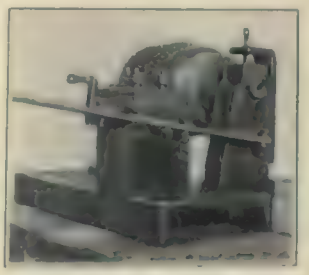
HAND HAMMER DRILL

Light, Hand-Hammer Drill

A SMALL, light, hand-hammer drill has been developed by the Ingersoll-Rand Company, New York, N. Y. This machine is known as the "Bar 33 Jackhamer." Its weight is 21½ lb. and it is recommended for drilling holes in concrete or other foundations, where a machine of extreme light weight is necessary. It is not recommended for drilling deep holes or for use in hard rock.

Commutator Slotter for Small Armatures

THE accompanying illustration shows a small, simple commutator slotting machine which was made up in the shops of the Georgia Railway & Power Company, Atlanta, Ga., to do the slotting work on the air compressor armatures. As there are only about two armatures to be repaired each week, it was not considered worth while to devise a power-driven machine using a revolving saw for cutting away the mica.



SMALL HAND-OPERATED COMMUTATOR SLOTTER FOR SMALL ARMATURES

In this machine a sharpened piece of hack-saw blade is held in the tool post by two yokes fastened to the tool head by four bolts and nuts. The tool head is shifted toward and away from the commutator by means of a crank and a ¼-in. screw. This tool post is also machined so that it may be moved laterally or axially by means of a lever having its fulcrum on the pedestal which supports the armature. This handle is attached to the tool head as seen, and a slot in the lever permits of oscillating the tool back and forth by means of the lever. The lever is 5 in. long from fulcrum to the point of tool head attachment and 12 in. long from this point to the end.



ELECTRICALLY-OPERATED TRAIN ON COAST DIVISION OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILROAD ON THE SUMMIT OF THE CASCADE MOUNTAINS

St. Paul Electric Service Out of Seattle Begins

Notable Inauguration of Service on March 5 Attended by Representatives of Railroad, Power and Manufacturing Interests

THE inauguration of electric passenger service on the Coast Division of the Chicago, Milwaukee & St. Paul Railroad occurred on March 5, 1920, when a train drawn by a General Electric locomotive made the run from Seattle to Cle Elum and return. On board was a party consisting of officials of the road, executive heads of the Puget Sound Traction, Light & Power Company and the Stone & Webster companies, representatives of electrical manufacturing companies, newspaper men from all over the Northwest, technical and trade journal correspondents, five motion-picture operators and a number of commercial photographers. In all 114 persons were on board the train as the guests of the Puget Sound Company which furnishes power for the operation of this section of the road. The trip occupied eleven hours, and the program worked out according to schedule. This locomotive is one of five which will furnish passenger service on the Coast Division, where the freight locomotives will be re-geared G. E. locomotives transferred from the Rocky Mountain Division. The passenger service formerly given with the last-named will be given with the new Westinghouse locomotives described, together with the G. E. machines, in the issue of this paper for March 13. The accompanying photographs show the train and the party, and give an idea of the scenic beauties en route. Officials of the Chicago, Milwaukee & St. Paul on the "special electrical" train were: H. B. Earling, vice president; Macy Nicholson, general manager; J. L. Brown, assistant superintendent of transportation; J. R. Veitch, assistant traffic manager; R. Beeuwkees, chief electrical engineer; F. B. Walker, assistant electrical engineer; H. W. Williams; A. P. Chapman, Jr., assistant general passenger agent; W. L. Hubbard (all from Seattle); E. A. Lalk, Tacoma; W. P. Warner, Spokane; F. J. Allman, Tacoma; F. C. Dow, Tacoma, and J. F. Bahl, A. J. McCarthy and R. F. Randall, Seattle. Others in the party were: W. S. Elliott, general manager, O. W. R. & N., Spokane; W. H. Wingate, trainmaster, Milwaukee, Seattle; William Emerson, traveling engineer, Milwaukee, Seattle; Frank Rusch, superintendent motive power, Milwaukee, Seattle; R. J. Middleton, assistant chief engineer, Milwaukee, Seattle; R. H. Dean, electrification department, Milwaukee, Seattle.



TRAIN STARTING ON RETURN TRIP FROM CLE ELUM TO TACOMA TERMINUS

Representatives of steam railroads and electrical manufacturing companies were guests on the trip, as follows: I. B. Richards, general superintendent Northern Pacific, Tacoma; W. H. Olin, assistant gene-



OFFICIALS OF THE MILWAUKEE AND PUGET SOUND TRACTION, LIGHT & POWER COMPANIES, NEWSPAPERMEN AND GUESTS OF THE COMPANIES ON THE INITIAL TRIP OVER THE MOUNTAINS. PICTURE TAKEN AT CLE ELUM, WASH.

ral freight and passenger agent, Oregon-Washington Railroad & Navigation Company, Seattle; H. F. Alexander, president, Pacific Steamship Company, Tacoma; A. M. Ingersoll, H. R. Williams, A. I. Bouffler, W. C. Dawson, C. D. Phillips, A. F. Marion, O. S. Bowen, A. R. Cook, Charles E. Peabody (all of Seattle and Tacoma); J. B. Cox, General Electric Company; H. E. Plank, General Electric Company, Seattle; W. D. McDonald, Westinghouse Electric & Manufacturing Company; Captain R. B. Childs, Inter-Mountain Power Company, Seattle; C. M. Riddell, mayor, Tacoma; J. W. McCune, chairman Tacoma Commercial Club; J. H. Davis, president Tacoma Commercial Club; Rene Martin, London; A. B. Howe, Tacoma; E. E. Kimball, General Electric Company; Allen W. Eshelby, Westinghouse Company, Seattle; S. Kaneko and Mosuke Higuchi, representing the Osaki-Shosen Kaisha Steamship Company, Seattle and Tacoma, and F. H. Shepard, director of heavy traction, Westinghouse Electric & Manufacturing Company.

The Puget Sound Traction, Light & Power Company was represented by A. W. Leonard, president; W. J. Grambs; D. C. Barnes; John Harisberger, superintendent of power; R. T. Sullivan, George Newell; H. B. Sewall; George Quinan, chief engineer; H. J. Gille, E. A. Batwell, E. H. Thomas, W. H. Somers, Judge C. W. Howard and Scott Z. Henderson.

As the details of this electrification have been given in several recent issues of this paper, they will not be repeated at this time.

A map of the newly electrified section of the road was printed on page 481 of the issue of the ELECTRIC RAILWAY JOURNAL for March 6, and a news account of the inauguration of electric service followed in the issue for March 13, page 533.



TRANSPORTATION OFFICIALS ON THE TRIP

Left to right: J. L. Brown, Assistant Superintendent, Milwaukee; Macy Nicholson, General Manager, Milwaukee; A. L. Bouffler, Seattle; F. M. Dudley, General Attorney, Milwaukee; R. F. Weeks, Division Freight & Passenger Agent, Milwaukee; H. W. Williams, Chief Draftsman, Milwaukee; H. R. Earling, Vice-Pres., Milwaukee; R. J. Middleton, Assistant Chief Engineer, Milwaukee; J. R. Veitch, Assistant Traffic Manager, Milwaukee; A. W. Leonard, President, Puget Sound Traction, Light & Power Company, Seattle; J. F. Bahl, Assistant Ticket Agent, Milwaukee; R. Beeuwkees, Chief Electrical Engineer, Milwaukee

C.E.R.A. Discusses Energy Saving

Paper by Prof. D. D. Ewing and Formal Discussion by Four Energy-Saving Device Manufacturers Are Features of Second Session — Abstracts of Two Papers on Bonding, Presented March 10, Are Published

A BUSY second-day session of the annual meeting of the Central Electric Railway Association March 10 and 11 at Louisville, Ky., was given over very largely to the presentation of a paper by D. D. Ewing, professor of electric railway engineering, Purdue University, on the "Economical Use of Electricity for Car Purposes," and the formal discussions by L. E. Gould, L. M. Clark, C. H. Koehler and William Arthur which followed. Abstracts of this paper and the discussions which followed will be published in a later issue. The report of the March 10 session and abstracts of two of the papers were printed last week. Abstracts of the other two papers of March 10 appear below.

President John F. Collins presided at the second session Thursday morning and made the paper and the discussions mentioned above the first order of business. At the conclusion of the discussion of these papers, Charles L. Henry commented upon the splendid points which had been brought out for making further economies in operating costs and admonished the members to put them into use, saying that the suggestions were of no value unless they were put into practice. He complimented the association and the program committee for the manner in which it had always gone down into the meat of things and developed studies and data and information which were of the greatest value to the member companies.

H. A. Nicholl, Anderson, Ind., when called upon to discuss the energy saving schemes, said that his company had recently undertaken an energy-saving campaign through the use of watt-hour meters because it believed that this would result in making available better data on the cost of operation, and would bring about a better distribution of equipment since it would show what cars were the heavier energy users. This made it possible to use the cars consuming the least power on those lines where the least power was available. It was also thought that valuable data would result as to the energy consumed by empty and loaded cars and that required for pull-ins; and further that the inspection of equipment on a kilowatt-hour basis, a plan afforded by the watt-hour meter, would result in economies of very great value indeed. Mr. Nicholl said that he thought the matter of energy saving through the use of one of the several devices was a subject which should be carefully looked into by every company.

As members of the committee on a national safety code to work with similar committees from other electric railway associations, President Collins appointed James Harmon, safety manager Interstate Public Service Company, New Albany, Ind., chairman, and H. A. Nicholl, Anderson, Ind., and E. C. Hathaway, Railway Audit Inspection Company, as the other members.

H. A. Nicholl, chairman, W. H. Bloss and Allen Edwards were appointed a committee of three to consider the president's address.

W. G. Stuck, master mechanic Kentucky Traction & Terminal Company, Lexington, spoke briefly of the plan of his company to equip all interurban cars with fare boxes on the rear platform and to make use of a combination pay-enter and pay-leave system of fare collections. Passengers boarding cars at the principal terminals will pass into the car without paying their fares but will receive a check on which appears the name of the town at which they boarded. These passengers will then pay as they leave the car, according to the distance traveled from the name which appears on the check. Passengers boarding the cars at rural points will pay as they board the car.

The election of officers was made an order of business at the Thursday session. Their names were chronicled in this paper, issue of March 13.

One of the pleasant features of the Louisville convention was that President Collins and a party of railway and supply men made the trip to and from Louisville in Mr. Collins' private car, the "Michigan." The round trip comprised over 1,200 miles. On the trip south, the car left Jackson, Mich., at 7 a.m., Monday, and arrived at Louisville at 8 p.m. Tuesday. The members of the party boarded the car principally at Fort Wayne and at Indianapolis on the trip south, and took leave of the car at these same points on the return trip. The route followed by the car was as follows: Jackson to Detroit via the Michigan Railway and Detroit United Railway lines; Detroit to Toledo, Ohio, via the Detroit, Monroe & Toledo Short Line Railway; Toledo to Lima, Ohio, and Fort Wayne, Ind., via Ohio Electric Railway; Fort Wayne to Bluffton, Ind., via Fort Wayne & Northern Indiana Traction Company; Bluffton to Muncie and Indianapolis via Union Traction Company of Indiana; and Indianapolis to Louisville, Ky., via Interstate Public Service Company. On the return trip the car proceeded from Indianapolis to Toledo by way of Dayton, Ohio, passing over the Terre Haute, Indianapolis & Eastern Railway, the Ohio Electric Railway, and the Western Ohio Railway.

The Interstate Public Service Company operated a special car from Indianapolis to Louisville and also a return car for the convenience of the delegates, a large party of whom availed themselves of this service.

Distribution Problems of Interurban Railways*

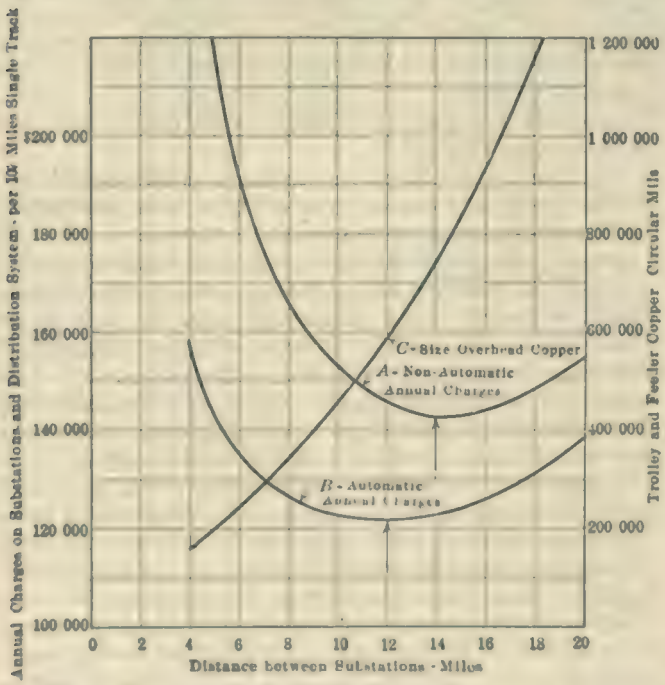
BY J. S. HAGAN
General Engineering Department Westinghouse Electric & Manufacturing Company

FROM an operating standpoint a high average voltage on an interurban line is very desirable. An article on "The Effect of Low Voltage on Railway Motors" by G. M. Woods in the ELECTRIC RAILWAY JOURNAL of Jan. 27, 1917, discusses the subject in detail, and points out the advantages of high voltage, and the disadvantages which result with low voltage. Because of the distances involved and the comparatively

*Abstract of paper read at annual meeting of Central Electric Railway Association, Louisville, Ky., March 10, 1920.

light traffic on the average interurban road, the expense involved in supplying substation and feeder capacity to maintain a high average voltage is very great. It is the purpose of this paper to consider the factors which enter into choosing the location of substations and size of feeders and bonds on interurban roads.

In operation the ideal condition would be obtained if the power distribution were such that the voltage at the cars would at all times be that of the substation. The most economical distribution system is that in which the fixed charges on the investment are equal to the cost of the power lost in the distribution system. The minimum average voltage at which typical car equipments will maintain a desired schedule is fixed



CURVES SHOWING ECONOMICS OF SUBSTATION SPACING

within limits; and the voltage which will occur with recurring "bunching" of cars should not be below 350 volts as minimum on a 600-volt line.

With a given substation voltage and substation spacing, the choice of sizes of trolley line, feeders and bonds is dependent upon the profile of the road, size of the rail, number of tracks, weight of trains, headway and schedule speed of the equipments operating. Since the voltage at the train is determined by the sum of the voltage drops in the overhead copper and the return circuit through the rails, it is evident that, all other factors remaining equal, less feeder capacity would be required if there were two tracks than if there were one. Less feeder would be necessary with a single track of 90-lb. rails, than with one of 60-lb. rails.

WEIGHT OF TRAIN IS A BIG FACTOR IN FEEDER REQUIREMENTS

The current required to accelerate a two-car train is twice that required for a single car, and with a given substation spacing the increase in the amount of feeder to keep the voltage the same is much greater than in proportion to the currents. To illustrate the effect which the train weight has upon the feeder required, assume that a 600-volt single-track road with 70-lb. rails and No. 0000 bonds has substations spaced 10 miles apart. Take the weight of a single car with load as 60,000 lb. Assume that cars run on a 30-min. headway and, with an average of one stop in two miles, make a schedule speed of 30 m.p.h. With these conditions there is never more than one car moving in each direction between substations. Assuming that one car is running while the other is starting at a passing track midway between substations as the worst voltage condition, there would be required 456,600 circ.mil of overhead copper to keep a minimum of 350 volts on the trolley at the car.

If multiple-unit operation with 2-car trains were advisable the same traffic would be handled by running on a 60-min. headway. As before, assuming that two of these trains were passing midway between substations, 1,381,600 circ.mil of copper in the trolley and feeders would be required to maintain the same minimum voltage as with single car. In this instance a 100 per cent increase in train weight required a 203 per cent increase in feeder copper. Actually, with such a difference in train weights the investment involved in increasing the number of substations and slightly increasing the overhead copper would be less than increasing the feeder by the amount indicated and keeping the same number of substations.

The selection of the proper gear ratio for different classes of rolling-stock has a very important bearing upon feeder capacity. An equipment which is geared for a high speed takes a high current in starting, and a greater amount of feeder and substation capacity is required than would be necessary with equipment geared for lower speeds. Where competition or local conditions demand high-speed passenger service, there is no alternative but to install substation capacity and feeders to take care of that service. However, on many lines equipments are geared for a speed greater than the service demands and might readily be changed to a lower-speed gearing with the resultant advantages of higher voltage.

LOCOMOTIVES SHOULD BE GEARED FOR SLOW SPEED

The question of slow-speed equipments is especially important with regard to freight haulage. A freight car or locomotive equipment which is geared for a speed comparable to that of a passenger car will impose a power demand which is too great for the substation and feeder system of the average road. A large proportion of the time a freight train is on the road is consumed in terminal, switching and standstill time, and the actual running time is comparatively small. A slight reduction in running speed therefore has little effect on the service rendered shippers, but the use of low-speed equipments is very advantageous to railways in reducing the peak demand on substations. By using slow-speed motors with maximum reduction gearing on locomotive and freight-car equipments, relatively heavy trains may be hauled and the power requirements are so low that in many cases, with proper dispatching, no additional substations or feeders are required.

From the foregoing it is evident that the feeder requirements for interurban roads will vary between wide limits. One 600-volt interurban road 17½ miles in length, handling comparatively light traffic, has only one power house and substation located at the center of the line. With stub end feeding distance of 8¾ miles only the No. 0000 trolley is used. A double-track 600-volt road in one of the eastern states, 90 miles in length is operating multiple-unit trains on a 40-min. headway. The substations are spaced approximately 10

miles apart, and two No. 0000 trolleys and 1,000,000 circ.mil of feeder extend the length of the road with several miles of 1,500,000-circ.mil feeder. Instances may be cited of roads using amounts of feeder varying between these extremes. Most interurban roads have No. 000 or No. 0000 trolley and from 300,000 to 600,000 circ.mil of feeder. However, the number of railways which do not come within these limits is so great that the only conclusion which can be drawn is that the distribution layout of each road must be considered separately to meet the local requirements.

A number of interurban roads are using 1,200 to 1,500 volts on the trolley. The effect of increasing substation voltage is apparent. The same factors which enter in determining substation spacing and feeder capacity for low voltages apply to the higher voltages. Due to the decreased current in transmitting a given amount of power a smaller number of substations of increased capacity and less feeder may be used with high voltages.

Good Bonding Is a Prime Distribution Necessity

The size of rail for an interurban road is determined primarily by the weights and speeds of the cars. Ordinarily, in outlying districts where electrolysis is not a determining factor, the rail size which will be most economical from a maintenance standpoint has sufficient conductance to provide a return circuit without additional negative feeders. In recent years the importance of maintaining a return circuit of low resistance has been recognized.

On interurban roads it is seldom that traffic is so heavy that the size of rail bonds is determined by continuous current capacity. Ordinarily, rail bonds which are large enough to keep the track loss within limits have sufficient capacity to carry the current without overheating, provided the bonding is in good repair. For instance, a No. 0000 bond will carry a current of 450 amp. continuously without overheating, and for short periods will carry five times that current. These values are in excess of the demand imposed by average interurban road traffic. The current-carrying capacities of bonds, of course, vary directly in proportion to their sizes. The resistance of the return circuit is more dependent upon having all joints well bonded rather than upon the use of heavy bonds. The length of bond is short compared to the length of rail, and the total $I R$ drop through the bonds is a small percentage of the total drop in the return circuit. In a track with 70-lb. rails and No. 0000 bonds 10 in. long, only 9.2 per cent of the total track drop is in the bonds if good contact is made with the rails. By the use of 500,000-circ.mil bonds the loss in bonds would be reduced to 4.6 per cent of the total track drop. Putting it in a different way, an increase in first cost of bonds of 137 per cent results in reducing the track drop by less than 5 per cent.

It is impracticable to use bonds which have a conductance equal to that of the rail. On this basis a 70-lb. rail would be bonded with 795,000-circ.mil copper, and a 90-lb. rail with 1,020,900-circ.mil copper. Since so little is gained by the use of large bonds, their higher first and maintenance costs are not justified. Mechanical considerations as well as current-carrying capacity fix the minimum size of bond for electric railway use at about No. 0. Practically the largest bond in use is 500,000 circ.mil. Most electric railways use expanded-terminal or welded No. 0000 bonds, 10 in. to 12 in. in length.

Up to this point the effect of the various factors on the choice of feeders and bonds has been considered on the assumption that the locations of substations were fixed. While the location of manually-operated substations may be determined to some degree by the existing freight or passenger stations, where the agents may serve as substation operators, in general it is possible to choose locations which will permit approximately the most economical layout of substations. For a given investment a relatively large number of substations and little feeder, or few substations and larger feeders, may be installed with the same loss of power in trolley and track. However, the sum of fixed and operating charges, or total annual charges, will be very different with different substation spacings.

With the automatically operated substation the elimination of substation attendance, except for inspection, is an obvious advantage. In many localities substation heating is eliminated, and in some cases the reduction of no-load losses of the substation effects a considerable saving in power. Due to the reduction in annual charges per substation, automatic substations may be more closely spaced than manually-operated ones. For the conditions of traffic which obtain upon each road there is combination of substation spacing and feeder size for most economical operation. These spacings are different for the manually-operated and automatic substations.

The accompanying curves illustrate the variations of annual charges with both manually-operated and automatic substations with various spacings for a set of conditions assumed nearly typical for a high-speed interurban line. On a 600-volt road having 75-lb. rails and No. 0000 bonds, single cars weighing 60,000 lb. are operated on a one-hour headway. The cars are geared for a schedule speed of 30 m.p.h. with an average of one stop in 2 miles. With these conditions the cars are spaced 30 miles apart, and with normal operation there is never more than one car moving in each direction between substations. It is assumed that the minimum voltage permissible with one car starting and one car running midway between substations is 350 volts, and the feeder requirements for each substation spacing are based on these assumptions.

In the diagram the abscissæ represent miles spacing between substations. Curves *A* and *B* show the total annual fixed and operating charges on the complete distribution system, except track, for manually operated and automatic substations respectively. Curve *C* shows the amount of trolley and feeder in circular mils required for each substation spacing to keep the minimum of 350 volts on the trolley at the car.

The points at which curves *A* and *B* become horizontal show the substation spacings and feeder sizes which are most economical for manually-operated and automatic substations. For this assumed case the proper spacing for manually-operated substations is 14 miles and 750,000 circ.mil of overhead copper should be used. With automatic substations the spacing is decreased to 12 miles, with 590,000 circ.mil of overhead copper. It will be noted that the total annual charges are less with automatic than with manually-operated substations, and that the greatest saving is made by increasing the number of substations and decreasing the amount of feeder.

It should be borne in mind that the exact relation of the curves depends upon the nature and volume of traffic, and that these curves are applicable only to the particular case set forth. However, the general relation of substation spacing for manually-operated and automatic substations is that illustrated.

The advantages inherent in automatic substations have only recently been recognized by railway operating men, and it is to be expected that most future substation installations will be of the automatic type. The interurban electric railway of the future will have single-unit automatic substations closely spaced, and relatively small feeders.

Some Bonding Results*

BY R. J. CUSTER
Engineer Maintenance of Way Interstate Public Service Commission, Indianapolis, Ind.

BETWEEN May 1 and Sept. 30, 1918, we installed 5,084 new No. 0000 bonds between the Indianapolis City Limits and Taylorsville with an electric arc bonding machine. This track is laid with 60-lb. A. S. C. E. rail and has been bonded with three or four different types of bonds including those with compressed, soldered and brazed terminals, the greater proportion of which had finally failed on account of broken strands or of having been knocked loose entirely.

Two men were used with the machine. At first they pushed it ahead on the rails from joint to joint. Later when the locations requiring rebonding became widely separated, the machine was placed on the line car and these places were bonded as the car passed over the road on its regular maintenance supervision.

The cost of installation of these 5,084 bonds was $2,807.60 or 55 cents each, the material cost per bond being 40.2 cents, and the labor cost 14.8 cents.

By the end of September we found that our power consumption had been reduced 0.76 kw.-hr. per car mile which, at an average production cost of 2.2 cents at the d.c. feeder, shows a saving of 1.67 cents per car mile. As production conditions at the power house remained the same and the same class of equipment was operated all through the period of bonding, this saving is undoubtedly due to the improved conditions produced by the new bonds. An illustration will show what this saving means. In September our car miles operated were 97,700 which at the 1.67 cent reduction in cost per car mile shows a saving for that month alone of $1,631.59. You can readily see that the entire cost of the installation of these bonds was very quickly returned.

Between Aug. 19 and Sept. 30, 1919, we installed 3,500 bonds on our track between Sellersburg and Jeffersonville. This track is laid with a 75-lb. A. S. C. E. rail and was originally bonded with two concealed bonds with compressed terminals. The condition of these bonds became so bad that a complete failure of our automatic signal system resulted.

The method of procedure on this job was as follows: The bonding machine was placed in an old city motor car, properly grounded and equipped with the necessary operating switches. All the supplies necessary were kept in this car. The bonding crew consisted of a motorman, a brakeman and the bonding operator. The brakeman kept the mould clamp loaded and adjusted ahead of the operator. The motorman followed the operator from joint to joint. During the last week's work on this job this crew worked at night and installed an average of 200 bonds in eight hours actual working time. The average number of bonds installed per day during the twenty-eight working days was 124.

The cost of installation of these 3,500 bonds amounted to $1,616.50 or 46.2 cents each, the material cost per bond being 35.1 cents and the labor cost 11.1 cents.

The average consumption per car mile for the three months following the completion of this job in comparison with that of the three months previous to the starting of the job showed a reduction in power consumed of 0.48 kw.hr. per car mile. The power on this portion of our line is purchased at an average cost of 2 cents per kw.-hr. delivered to the d.c. feeder so that our saving is here shown to be 0.96 cent per car mile. As 51,192 car miles were operated during these latter three months, our saving will amount to $491.44 or an average of $163.81 per month. In this instance the cost of installation will pay for itself in power saved within ten months after the completion of the job.

After the installation of these bonds, in each case, it was noticed by the trainmen that it was easier for the trains to make their regular running time and this fact was often called to our attention by them.

*Abstract of paper presented before Central Electric Railway Association meeting at Louisville, Mar. 10.

Keeping Dust Out of Armatures

FEW electric railways appear to realize the desirability of covering railway motor armatures after rewinding, to protect them from dust, but at the Salem (N. H.) shops of the Massachusetts Northeastern Street Railway all armatures stored on racks are covered with discarded car curtains as shown in the accompanying



ARMATURES COVERED WITH CURTAINS

photograph. The curtains are wrapped around the armatures and fastened in place with tape, and this simple expedient is undoubtedly a factor in reducing service troubles.

Richard Sachse, chief engineer Railroad Commission of the State of California, states that great interest has been manifested in England, France, Germany, Sweden and Japan in the report on inductive interference, which was reviewed in the issue of this paper for Feb. 28, page 455.

Oklahoma Utility Men Meet

Publicity, Mutual Insurance and Franchises Were Among the Subjects Discussed

THE Oklahoma Public Utilities Association, the membership of which is composed of officials of traction lines, electric light and power companies, gas companies, waterworks and other public service corporations, which met in an annual convention in Oklahoma City, March 9-11, adjourned with a banquet on the night of March 11. The convention elected officers as follows:

J. W. Shartel, vice-president of the Oklahoma City Railway Company, president; C. E. Devin, Apache, first vice-president; J. M. Gayle, Oklahoma City, second vice-president; William Mee, Oklahoma City, treasurer; H. A. Lane, Oklahoma City, manager. The new members of the Executive Commitee are: E. W. Smith, Okmulgee; W. H. Crutcher, Oklahoma City; W. W. Lowe, Bartlesville; C. E. Devin, Apache; J. M. Gayle, Oklahoma City; F. B. Hathaway, Oklahoma City; J. G. Cronin, Oklahoma City.

R. C. King, an accountant of McAlester, was awarded a prize for the best explanation of the duty of a public service utility to the people.

A committee that has been working out a plan for compensation insurance for the utilities, reported that the details of the plan would be completed within a short time and submitted to the members of the association for their consideration.

The Legislative Committee reported that it had no special legislation to urge, but suggested that steps should be taken soon toward securing a revision of the system for taxing utilities, and also that provision should be made for indeterminate franchises for all public utilities. This is important, it was pointed out, when a utility faces the problem of securing money with which to make extensions and improvements to its service.

Bernard J. Mullaney, general manager Peoples' Gas, Light & Coal Company of Chicago, in an address declared that frankness on the part of public utilities in presenting to the public its claim for community support was important because the people should know the facts concerning the operation of a utility and should not merely be fed up on a lot of propaganda. Absolute frankness, he said, would go much farther in getting the desired results than any other course that might be pursued. Mr. Mullaney said that this idea had been carried out in Illinois in as practical a way as could be arranged up to the present time. The home paper, he told the convention, was the proper place for the manager of a utility to appeal to the people for community support, but he added that there were other ways in which this could be augmented.

A. Hardgrave, American Public Service Company, Dallas, Texas, said that the problem of operators having to appeal to the money markets in selling stock could be obviated somewhat by selling the securities locally to customers. He said this undoubtedly would improve the attitude of the public toward utilities.

H. S. Cooper, secretary Southwestern Gas & Electric Association, Dallas, Texas, discussed "current stealing," and told how effective work has been done in Texas, with the help of a State law, in discouraging this popular means of "beating" the electric light companies. Mr. Cooper was requested to send to the secretary of the Oklahoma Association a copy of the Texas law which would be used as a model in framing a bill to be presented to the Oklahoma Legislature.

Drilling Square Holes in Solid Material

A DEVICE for drilling a square hole in metal without previous preparation, which can be attached to a milling machine or drill press is being marketed by the Fairbanks Company of New York City. The trade name for the attachment is "Radebore Head."

The accompanying illustrations show how the holes are drilled. The attachment end of the drill is arranged for a swivel connection and has a positive drive from

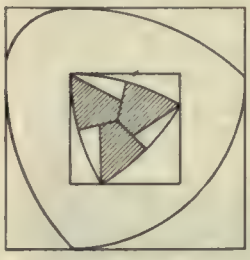


FIG. 1

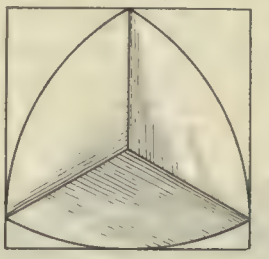
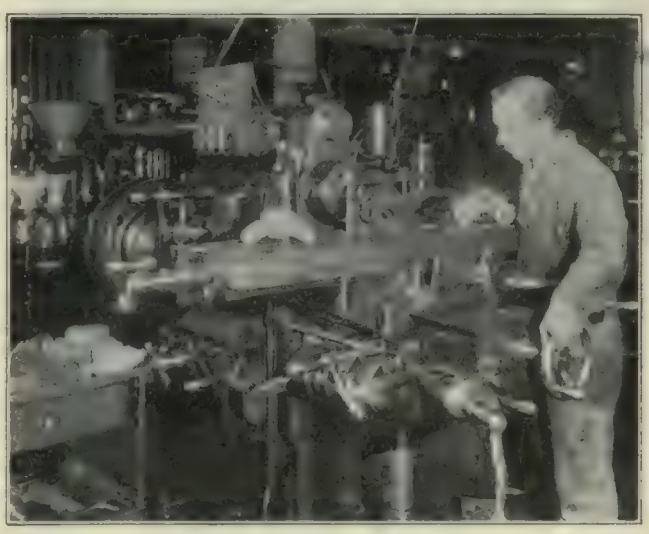


FIG. 2.



FIG. 3.

Drill, guide and cross-section of drill shank



DRILLING SQUARE HOLES IN ROCKER ARMS

the spindle of the machine. The shank of the drill follows around inside a square guide formed by the adjustable jaws of the head. Cutting edges are ground on the end of the drill. When the type of drill shown in Figs. 2 and 3 is used, square holes with "filleted" corners will be drilled. To make a hole with square corners a shank as indicated in Fig. 1 is used with one cutting edge longer than the other so that this will go into the corners to square them. The cutting lips follow a path determined by the adjustable jaws of the head so that no preliminary round hole is necessary.

Drills of two styles are manufactured, one producing a hole with rounded corners, and the other designed for die work and for squaring the ends of keyways, etc.

The heads or chucks are made in four sizes and two different styles. The range of drills is from $\frac{1}{8}$ in. to 2 in. x $\frac{1}{16}$ in. steps for the type of drill which produces round corners and from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. x $\frac{1}{16}$ in. sizes for the type producing sharp corners.

Compressor Overhauling Practice in Buffalo

A Definite General Overhauling Schedule for Car Equipment Assists in Keeping Parts in the Best Operating Condition

BY J. W. HULME
Superintendent of Equipment International Railway, Buffalo, N. Y.

THE apparatus necessary for compressing, storing and regulating the pressure of air for electric cars is becoming more and more a vital consideration in the efficient operation of cars. When air compressors were first installed on electric cars, their sole purpose was to provide compressed air for use in the braking system in stopping the cars. From this beginning the use of air has extended to nearly all parts of the equipment, and when we look at the situation today we find compressed air used for operating the control equipment which starts and controls the car while it is running, for operating the braking system, for operating the entrance and exit door mechanism, for applying sand to the rails, and in some cases for raising and lowering the trolley poles. This increased use of air has materially reduced the manual labor necessary in operating the car and at the same time has increased the schedule speed for the line, reduced the length of stop, and also decreased to a great extent the number of boarding and alighting accidents.



REMOVING A COMPRESSOR FROM THE CAR



AIR DEPARTMENT OF THE INTERNATIONAL RAILWAY

The possibility of run-ins due to air failure has increased with this added use of the air parts, so that those responsible for the maintenance of this equipment have been forcibly impressed with the vital importance of equipping all cars with the best air-brake equipment obtainable and then keeping it in first-class operating condition by periodical inspection and general overhauling. To meet these conditions the International Railway has given particular attention to this phase of its equipment, and as now arranged a regular weekly inspection is provided for, with a definite overhauling schedule in addition. This overhauling schedule provides for the cleaning of brake cylinders every year, and the general overhauling of all electrical and mechanical parts of compressors, motormen's operating valves, governors, door devices and sand valves every two years.

The overhauling of compressors requires their removal from the car, and the complete dismantling and cleaning of all parts, together with their renewal and reassembling with proper lubrication for the wearing parts. The compressor is removed from the car by means of a truck which has an adjustable height, as shown in an accompanying illustration. By the use of this truck one man can perform all the work necessary for removing the compressor and transporting it to the air room for thorough overhauling. In the air room, before any attempt is made to dismantle the parts, the compressor is thoroughly cleaned. For this purpose it is placed on a specially designed table 25 in. high x 36 in. wide and 96 in. long. This table is covered with No. 16 gage sheet iron. A solution of three parts of kerosene to one part gasoline is used to clean the outside casing of the compressor. After all dirt has been removed, the oil from the crank and gear case is drained out carefully and filtered for re-use as occasion demands.

After the compressor has been thoroughly cleaned on the outside, it is taken apart and the armatures, fields and brush-holders are sent to the electrical department for test and overhauling. The work in the electrical department comprises a thorough cleaning and any necessary tests to determine just what repairs are necessary. Of course, any grounds, short-circuits, or open circuited connections are repaired and then the fields and armatures are dipped in varnish and thoroughly baked.

On the overhauling bench in the air room, the mechanical parts of the compressor are thoroughly cleaned, the crank shafts and pistons are inspected and repaired, so that when they are again returned to service they will be in as good condition as when new. With all parts cleaned and repaired, the compressor is again assembled and tested. To provide for a careful running test, a testing rack has been fitted up to which the compressor is connected. During the test, careful attention is given to make certain that the operation of the compressor does not require more than the predetermined current. Also the air gage, which is connected to the storage tank into which air from the compressor is forced, is watched closely, and the hand of the gage must travel smoothly between the ranges of 80 lb. at which the governor cuts in to 100 lb. where the governor cuts out. After this test the pressure is reduced to 60 lb., and the time required to increase the pressure

from this amount to the cutting-out point which has been previously determined is measured. Ordinarily, the compressor is run for fifteen minutes continuously to insure that the electrical equipment is in first-class condition. In case the piston cylinders have been bored out, and bushings with new piston rings have been installed, the compressor is run for five hours with the bleed cock open so that the governor will cut in every ten seconds. This test is made so as properly to "work in" the various parts.

The governors, gages, motormen's valves, safety valves and door devices receive an equally rigid overhauling as do the compressors. All air pipes on the car are blown out to clear them of scale and are carefully tested for leaks.

Extension for Short Poles



POLE EXTENSION

THE advancing cost of labor and materials has led to the development of an extension for poles. This is being marketed by S. W. Hull & Company, Cleveland, Ohio. Two main compression members constructed of steel angles reinforced by steel bars comprise the frame, which may be fastened to the top of a pole by three through bolts. The construction permits of a large number of cross arms being installed; thus one can be bolted at every intersection of the lace bars. The main compression members open and close to fit any size of wood pole top.

In addition to this extension being used where it is necessary to increase pole height, this has also proved advantageous where poles have become butt-decayed. The old pole can be cut off at the ground and reset by the addition of a Hull extension frame, so as to give the original height.

New Feature in Casing for Jet Condensers



VERTICALLY SPLIT CASING OF PUMP

A NEW feature in the vertically split casing of the tail-pump for vertical jet condensers, as manufactured by the Wheeler Condenser & Engineering Company, Carteret, N. J., has been brought out, and is illustrated herewith. This feature permits easy and quick removal of the pump rotor or other internal parts for inspection or repairs. The improvement is being added to two types of jet condensers manufactured by this company, the vertical jet condenser and the rectangular type counter-current condenser. Another feature is the use of an expansion joint between the pump and the condenser body. This joint is designed to take care of changes in length due to temperature variation.

Concrete Stringer Tieless Track Construction

Southern Public Utilities Company Has Standardized on Unique Construction, Believing It to Be the Most Satisfactory Type of Rigid Track

A RIGID type of track construction with the rails set in concrete and anchored by means of long hook bolts and without the use of any cross-ties, has been made standard construction by the Southern Public Utilities Company, which operates the street railway systems Charlotte and Winston-Salem, N. C., and Greenville and Anderson, S. C. This construction was originated by E. F. Taylor, formerly general manager of the company, and is unique in many respects.

The most conspicuous feature of the construction is the absence of ties. The rails are fastened by Carnegie clips directly to ⅜-in. x 8-in. steel plates, and the bolt in every other clip extends down into a concrete beam and hooks around a ½-in. corrugated iron bar which is laid continuous. The complete construction details are shown in the accompanying drawing.

The rail used is 70-lb. standard A.S.C.E. section, and the longitudinal plates on which the rail bears are



APPEARANCE OF THE SURFACE OF THE COMPLETED TRACK IN ANDERSON, S. C.

cut the same length as the rails and laid with the joints staggered so that they come at the center of the rail. The rail clips are spaced on 2-ft. centers except at the rail joints, where they are much closer together, as shown on the drawing. All clips at the joints are fastened with the long hooked bolts.

The rails are not welded at the joints, but A.S.C.E. angle bars are used. These are standard except for the holes and the notches for the clips. In addition to the ⅜-in. x 8-in. steel bearing plates described above, a piece of 10-in. channel iron, 42 in. long is placed beneath each joint further to increase the bearing area. The only cross connections betwen the rails are the ⅜-in. x 1½-in. tie rods spaced 2 ft. either side of the rail joints and 9 ft. 8 in. apart for the remainder of the length of the 33-ft. rail.

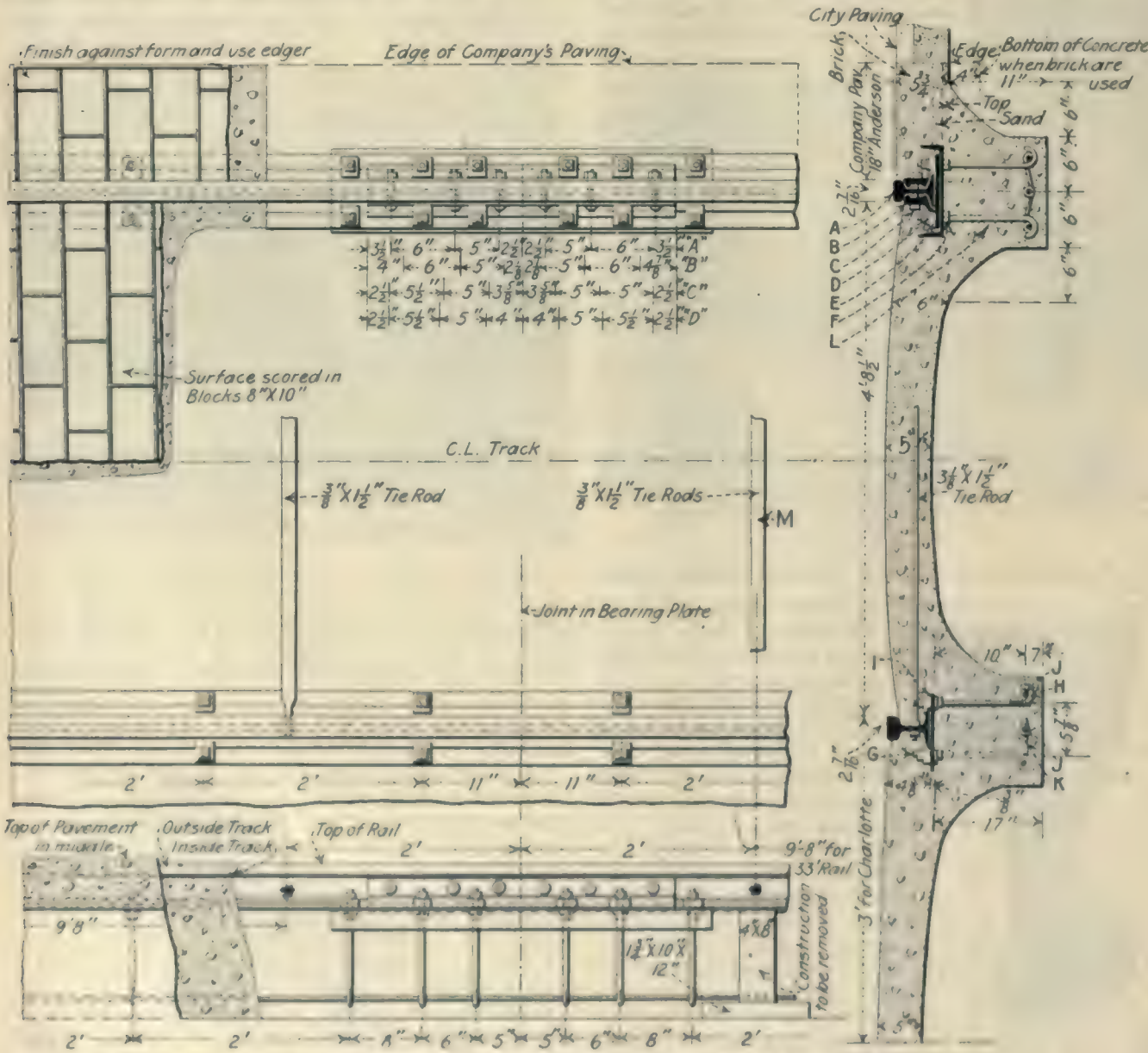
The concrete foundation is of such cross-section as to give a longitudinal concrete beam or stringer under each rail. This stringer is 17 in. deep and 12 in. wide. Between the rails and between the tracks the thickness of the concrete decreases to 5 in. at the center. An expansion joint is provided every 33 ft. and no trouble has been experienced from cracking between expansion

joints. S. L. Duckett, engineer, states that extreme care must be used in placing concrete under the rail joints and the joints must be well grounded. It will be noted in connection with the joint construction that the channel iron is installed with the edges turned up in order to insure that the concrete shall be properly placed beneath it. The tie rods and a wire net reinforce the concrete between the rails.

Reinforcement in the longitudinal beam is secured by the use of three ½-in. corrugated bars under two of which the rail clip bolts hook. These three corrugated bars are tied together by a wire support which holds them suspended from the rail clip bolts during the pouring of the concrete. The top 2-in. surfacing of the concrete is in the proportion of one part sand to one part aggregate, while the remainder is a 1:2:4 mixture. The concrete is allowed to cure for twenty-eight days whenever practicable, as it has been found to wear better when given plenty of time to harden.

The company has approximately 12 miles of this type of construction in use, of which about 4 miles has been in service four years and the remainder for various shorter periods. The cars which have been operating over this track vary in weight from the light 13,000 lb. safety car to the heavier four-motor, double-truck 29,000-lb. cars.

A brief signed article by Mr. Taylor about this same type of construction, recently appeared in the *Concrete Highway Magazine* which is published by the Portland Cement Association. In that article Mr. Taylor stated that experience had shown this type of construction to be the most satisfactory of the three types of rigid construction which have been used by the company, namely, the type described here, the familiar 6-in. concrete base underwood ties, and a substitution of steel ties on 4-ft. centers for the wood ties. Mr. Taylor said further: "We have found that concrete is the most substantial of the various types of pavement, present-



FULL CONSTRUCTION DETAILS OF TIELESS CONCRETE BEAM TRACK

A—A.S.C.E. 70-lb. rail, 33 ft. long.
B—A.S.C.E. splice bars punched as shown and notched as shown for clips ⅜ in. clear.
C—Bolt, standard ¾-in. track.
D—High-tension ¼-in. washer for ⅞-in. bolt.
E—Carnegie rail clip No. 103. See detail.
F—Hardwood or fiber washer. See detail.
G—⅞-in. x 3-in. standard bolt.
H—⅞-in. anchor bolt. See detail.
I—⅜-in. x 3-in. continuous plate. See detail.
J—½-in. corrugated bars, continuous (20 ft.).
K—Wire support.
L—10 in. 15 lb. C. under joints.
M—⅞-in. x 1½-in. track tie rod

ing a wearing quality in connection with railway work far superior to other types of pavement. When the concrete is properly installed there is no creeping of the rail, and practically no deflection is caused by the action of traffic over the rail because of the rigid contact throughout its length."

Association News

Delegates to Chamber of Commerce Meeting

THE American Electric Railway Association has appointed representatives to attend the annual meeting of the Chamber of Commerce of the United States to be held at Atlantic City, April 27-28-29. They consist of Lucius S. Storrs, who is a national councilor, and the following delegates: J. N. Shannahan, W. A. Draper, Britton I. Budd, P. J. Kealy, P. H. Gadsden and Charles L. Henry. If any officials of member companies of the association expect to attend this convention as delegates from their local chambers of commerce, they are urged to notify Secretary Burritt promptly of the fact.

A meeting of electric railway men in attendance at Atlantic City will be arranged to insure proper attention to any matters affecting the industry which may come up for consideration at the general meeting, and information as to representation of member companies, railway and manufacturer, who will be at Atlantic City, is necessary so that this meeting may be arranged for in advance.

Questionnaire on Curved Head Rails

SECRETARY E. B. BURRITT, on behalf of the committees on way matters and equipment of the Engineering Association, has sent to member companies, which have used curved-head rails a questionnaire designed to bring out the facts regarding the use of these rails. The list includes twenty-four questions relating to rail and wheel contours and to the results which have been secured with curved head rails, and the committee hopes to secure operating data which will permit correct deductions to be made. Inclosed with the questionnaire form was a blueprint showing a curved-head design as applied to the association standard 7-in. grooved girder rail. The contour shown in the print is one that has been in satisfactory service on a number of properties. The committees hope that returns will be in their hands not later than April 15 and preferably by April 1.

New T. & T. Committees

PRESIDENT W. H. COLLINS of the Transportation & Traffic Association has announced the membership of the committee on merchandising transportation. Some changes are also announced in the personnel of the committee on express and freight traffic facilities and costs as given in the issue of this paper for Jan. 31. The full personnel of these two committees is as follows:

Committee on Express and Freight Traffic Facilities and Costs: C. E. Thompson, Chicago, North Shore & Milwaukee Railroad, Highwood, Ill., chairman; P. P. Crafts, Eastern Massachusetts Street Railway, Boston, Mass.; J. H. Crall, Terre Haute, Indianapolis & Eastern Traction Company, Indianapolis, Ind.; E. W. Fowler, Illinois Traction Company, Peoria, Ill.; R. B. Hull, Conestoga Traction Company, Lancaster, Pa.; F. D. Norviel, Union Traction Company of Indiana, Anderson.

Committee on Merchandising Transportation: W. J. Flickinger, Connecticut Company, New Haven, chairman; J. H. Alexander, Cleveland (Ohio) Railway; J. S. Bleeker, New Orleans Railway & Light Company; W. H. Boyce, Beaver Valley Traction Company, New Brighton, Pa.; F. G. Buffe, Kansas City (Mo.) Railways; F. R. Coates, Toledo (Ohio) Railway & Light Company; M. B. Lambert Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; Richard Schaddelee, Grand Rapids, Grand Haven & Muskegon Railway, Grand Rapids, Mich.

Coming American Committee Meetings

THE Convention Location Committee of the American Electric Railway Association is scheduled to hold a meeting at Atlantic City on March 24. The membership of the committee this year consists of Thomas W. Casey, National Pneumatic Company; H. Fort Flowers, Differential Car Company; John M. High, Pantasote Company; Martin Schreiber, Public Service Railway, and George Keegan, Interborough Rapid Transit Company.

The committee on national relations, of which Charles L. Henry is chairman, has scheduled a meeting in Washington for March 19.

F. R. Coates, chairman of the committee on company membership, has called a meeting of that committee in Toledo on March 30.

Lawyer Addresses Public Service Section

AT ITS meeting held on March 10, the Public Service company section was addressed by Howard MacSherry, of the company's counsel, on the topic: "Questions of the Hour." The speaker took up a rather unusual line of thought for such meetings, but it proved to be one very instructive and stimulating to the audience. He gave a general picture of the economic situation in this country, which has come about on account of the world war, which, he said, had not settled any of the great world problems. These problems, in the speaker's opinion, could not be settled by mass movements, but must come about by the regeneration of the individual, using this term in its broad meaning.

The causes of unrest, said Mr. MacSherry, may be classified as follows: First, there are political causes, which ultimately come down to selfishness; then there are economic causes, and finally there is the manifest desire to make people better by passing laws. While the picture painted by Mr. MacSherry was a somewhat gloomy one, he did not consider it a legitimate cause for discouragement but urged his hearers to help improve the situation by diligence in their work and loyalty to their employers. He sensed a changing attitude on the part of the public toward corporations, and in particular to the Public Service Corporation, as people appreciate more and more that it is only through union and co-operation that great things can be done.

Following Mr. MacSherry, H. H. Norris, ELECTRIC RAILWAY JOURNAL, gave a brief account of a recent visit

to the Toledo section, where he found a fine spirit and evidences of close co-operation between the Toledo Railway & Light Company and the members of the section. For the membership committee, Mr. Shepard reported an increase of seventeen members during the past few months, with a determination to push toward the goal of 500. Chairman N. W. Bolen reminded the section of the slogan "A full house" and said that the next meeting would be "Past President's Night."

Rhode Island Company Section Active

AT THE Jan. 8 meeting of the Rhode Island section, the speaker was Zenas W. Bliss, one of the receivers of the company, who gave a talk on "The Relations Between the Street Railway and the Public."

Mr. Bliss first reviewed his twenty years of service in various municipal offices and his connection with the public along financial lines, and said that he was somewhat inclined to think that electric railway transportation had not kept up quite with the times in all cases. He pointed out that business is absolutely dependent upon transportation in these days, whereas this was not true some time ago. Now if there is an interruption of transportation service vast numbers of people cannot get to work and great suffering is the result. There is a mutual responsibility between the corporations and the public, and there must be some way of properly adjusting their relationship by a properly organized government tribunal. There is a difference between government ownership and government control.

Mr. Bliss expressed the belief that it is possible to get the benefit of private enterprise with entire ownership by the state, which should lease the property to individuals. He concluded with these words: "While this problem in which we are so greatly interested is a very big problem, it is not the only one that we have. If other problems which are confronting us are not properly solved, our own problem will not matter much. The very foundation of our government is at stake. The solution of these problems is good citizenship, and without it none of them can be solved."

In addition to the address by Mr. Bliss, the company of 100 persons was entertained with music, dancing and refreshments.

At the meeting held on Feb. 12 the speaker was George H. Martin, Westinghouse Traction Brake Company, Boston, Mass., who spoke on "The Mechanical Equipment of the Safety Car." This talk was illustrated by means of lantern slides, showing the construction and operation of the many parts that go to make up the safety devices on the newest type of car. The membership on this occasion was entertained by a local impersonator. A nominating committee was appointed to report at the next meeting.

According to the *National Safety News* in 1910 there were 400,000 automobiles in the United States and out of every 100,000 population during that year, two and one-third persons were killed by automobiles. In 1917 there were 3,000,000 automobiles and nine and one-sixth persons out of every 100,000 population were killed by automobiles. During 1920 9,000,000 automobiles and trucks will be in use. The *News* asks: "How many thousand persons will be killed?" The answer, it says, "depends on you."

Letter to the Editors

European Relief Through Food Drafts

AMERICAN RELIEF WAREHOUSES

NEW YORK, March 1, 1920.

TO THE EDITORS:

I am sure that my fellow engineers will welcome an opportunity to assist in practical support of the relief measure for the civil population of the larger cities in Eastern and Central Europe. We have inaugurated a simple method by which it is possible:

1. For an individual in America to supply a relative or friend in Europe with a food package on payment in dollars at any one of several thousand banks in America.

2. For anyone desirous of helping to give to the unfortunate without naming a particular relative or friend.

This is made possible by a "Food Draft" which can be bought here, mailed abroad, and is good for the equivalent in food when presented at any one of our five central warehouses in Europe. Some four millions of our people are foreign born or have close foreign affiliations. A large proportion of these people are operatives in our mines and large technical industries.

This is not a "charity" in the ordinary sense of the term because we give much more than the same number of dollars could possibly buy in Europe if remitted in money at the present rate of exchange. Further, if the transaction is not completed in ninety days the purchaser of the draft is entitled to a refund, less a small charge for handling. Profits which may be derived from these operations will be credited to the European Children's Fund for child feeding in the country where the draft is presented.

HERBERT HOOVER.

[Electric railway companies with any considerable number of foreign-born employees might very well call the attention of these employees to the ease which this plan affords of supplying food to designated individuals abroad. The American Relief Administration carries stocks of staple foods in Hamburg, Warsaw, Vienna, Prague and Budapest. Out of necessity, delieveries can be made only at these warehouses but further shipment can be arranged locally by the recipient.—EDS.]

VIENNA, March 1, 1920.

TO THE EDITORS:

The American Relief Administration has established an American Relief Warehouse in Vienna, Austria. It is possible to buy at any bank in the United States American Relief Warehouse food drafts and send them to us in Vienna. On presentation of these food drafts at the warehouse in Vienna, we can draw American food. We are in great need of food in Austria. Individual food parcels sent from America usually do not reach us. Money does us no good when there is no food to buy.

Help us in our distress by sending an American Relief Warehouse food draft—quickly.

ILLUSTRIERTE MONATSFACH,
ZEITSCHRIFT "DIE LOCOMOTIVE."

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Toledo Vote in June

Protest Against Delay Until August—City May Issue General Credit Bonds

The action of Council at Toledo, Ohio, in extending until Aug. 10 the time at which a franchise settlement of the railway controversy at Toledo is to be submitted to the voters has brought forth a storm of protest from the members of the commission which drafted the cost-of-service measure.

Judge John M. Killits has also suggested that the date for the submission of the ordinance be made as soon as possible. He suggests that the company return the ordinance with objections in writing not later than April 3 and that Council and the franchise commission go over the measure in an attempt to harmonize all parts of it with company suggestions within three weeks after that date.

This would provide for an election in June rather than on Aug. 10, the date of the county and state primaries. Council may be asked to reconsider its resolution adopted last Monday night.

Henry L. Doherty has offered to pay the expenses of a special election rather than have the proposition go to a vote at the presidential primaries on April 27, before he would have time to make corrections in the proposed ordinance. Mayor Cornell Schreiber and Federal Judge Killits oppose this proposition.

In a letter to the Toledo Railways & Light Company, Federal Judge Killits submitted a copy of the ordinance prepared by the cost-of-service commission, which was appointed as an agency of the court to help solve the railway problem after the cars were brought back under the joint auspices of the City Council and the federal court.

The letter to the company follows:

By the consent of the city of Toledo I am submitting to you herewith copy of a service-at-cost street railway ordinance, the submission being under this condition: That you return the measure to me on or before April 3 with your comments thereon in writing, containing (a) a clear statement of the several objections of the company to the draft as now submitted, and (b) a draft of the several modifications the company deems necessary to meet its objections so stated above.

Upon the receipt of the draft ordinance with your comments upon it within the lines above stated, I will refer the matters to the commission with the request that it give your stated position careful consideration, with a reasonably limited opportunity for oral discussion, and will request the commission to submit again the draft ordinance to me with such modifications of the present form as it may then deem advisable within three weeks after the final reference. It is my intention then immediately to transmit the commission's conclusions to the Council, without any consideration thereof by myself.

You will kindly note that there is no obligation upon the company to consume all the time afforded it by this submission, and it will be very gratifying if the company is able to and will reduce the time of its consideration.

The commission appointed by Judge Killits to draft an ordinance providing for municipal ownership of the railway system has not held a meeting for several weeks. It has been waiting the decision of the Supreme Court on a test case involving the right of the city to issue bonds against the general credit of the city for the purpose of buying a street railway property.

The Ohio Supreme Court ruled on March 16 that the city of Toledo could issue bonds against the general credit of the municipality for the purchase of a public utility. This decision will allow the municipal ownership commission to proceed to draw up an ordinance providing for the purchase of the street railway property of the Toledo Railways & Light Company. The written opinion of the court will not be published for several days but Chief Justice Nichols gave out this statement:

Municipalities of the State are empowered by constitutional provisions to acquire any public utility, the product or service of which is to be supplied to the municipality or its inhabitants and they may issue bonds to raise money for such purpose, pledging the general credit of the municipality to their payment within the limits prescribed by the Legislature as to the amount of indebtedness for local purposes.

No legislative grant of power is essential. The issuance of such bonds may be limited or restricted by legislative act not as to purpose, but only as to amount of indebtedness the municipality may incur.

The city authorities will attempt to have both the cost-of-service and the municipal ownership ordinances ready to submit to the voters at one election. It is expected the date for election may be advanced to early in June.

Improvement Plan Precipitates Fight

The Dallas (Tex.) Railway is hampered in its program of betterments and improvements in Dallas by controversies among patrons as to the most desirable routes for proposed extensions. The company had announced its building program for 1920, this had been approved by the City Commission and requisitions covering the improvements had been issued. One of the extensions covered an addition in Oak Lawn. Residents of that section have become involved in a controversy as to the most desirable routing of the extension. As a result the court has granted an injunction against the company restraining it from carrying out the proposed extension. The company will take no further action toward building that extension until the injunction is dissolved and the action against the company dismissed. The material for the extension has been assembled, as it was the first new line to be built under the 1920 program. This material will now be used in other parts of the city.

Much Ado About Nothing

Kentucky Interests So Conflicting Nothing Is Expected to Come of Utility Legislation

There are three bills before the Kentucky Legislature looking toward the regulation of the public utilities of the State. One of these bills provides for the creation of a Public Utilities Commission, but in its present amended form the measure would apply only to the gas companies. The second bill would put the gas companies under the State Railroad Commission. The third bill proposes home rule. It appears likely, however, that nothing further will be done toward regulating the utilities than to place the gas companies under the jurisdiction of the Railroad Commission.

Governor Pledged to Economy

Governor Morrow was elected on a platform which promised that there would be no multiplication of state offices so that it is probable that the first bill mentioned above creating a new commission will not be passed. Moreover, if the proposed bill creating a public utilities commission is constitutional, then it would seem that the Railroad Commission might already be considered to have jurisdiction over the public utilities. There is the consideration also that such a bill, according to present statutes, would have to include jurisdiction over all municipally-owned utilities. This fact makes it highly improbable that the commission will be created, since none of the municipalities would tolerate the idea of having an outside body assume jurisdiction over local waterworks systems, for example.

Opinion Not Unanimous

The bill giving jurisdiction over utilities to the Railroad Commission may not be passed because neither the utilities men nor the members of the Legislature are agreed on what is or is not wanted, other than that the general object of all of the proposed bills is to provide some means of controlling the gas companies.

There is also believed to be little likelihood of the third bill passing because the cities already have adequate jurisdiction over their utilities along lines and procedures specified by law. To open the control to a free hand on the part of the cities would, of course, meet with opposition.

As regards the proposed bill to create a public utilities commission, there is some doubt as to the constitutionality of such measure. The sentiment of home rule is also very strong.

Railway Settlement on Business Basis

Kansas City Chamber of Commerce Proposes Service-at-Cost, With Remission of Paving and Other Charges

The business men of Kansas City, Mo., have a program in mind for the improvement of electric railway transportation in that city. This program provides among many other things for service at cost, the entire remission of any charges against the Kansas City Railways for paving, street cleaning and snow removal and also contains financial details largely of local interest.

The plan for future action is based on the recommendations contained in a report by the executive committee of the committee of one hundred of the Chamber of Commerce. The full committee of one hundred met on March 5 and approved the report and the board of directors of the full Chamber then approved the recommendations. The recommendations are summarized as follows:

That the franchise be amended so the service-at-cost principle will be included and providing for a variable fare and a variable rate of return on capital invested.

That charges such as licenses, paving costs, snow removal, street cleaning and sprinkling, and lighting, be remitted, since these only increase the fare and have no place in the operation costs of a railway.

That the section of the franchise requiring certain prescribed investments in extensions each year be repealed, and that only such extensions be required as the board of control deems necessary and believes will be self-sustaining.

That Kansas City, Mo., and Kansas City, Kan., co-operate in working out uniform franchises for both cities.

That new capital, so far as is possible, be in the form of stock investments instead of bonds, since the present financial structure is top heavy in that the proportion of borrowed money to the stockholders equity is too high.

VARYING RATE OF RETURN

That the rate of return provide for a minimum of 6 per cent on stockholders' equity, the normal return being 7 per cent with variations up and down in 0.5 per cent steps, varying inversely with the fares—the higher the fare the lower the return on capital.

That the city directors publish monthly or quarterly financial and operating statements in simple form for the information of the public.

That the franchise valuation, plus the additions that have been made by the board of control, be made the basis of the valuation for the "service-at-cost" plan. (It is not recommended that a re-valuation be made at this time, because such action could only result in a greatly increased capital value.)

That the company provide means of receiving and acting promptly on complaints and suggestions from the public.

That larger and better trailers be used on the lines where physical conditions will permit their operation.

That service in the outlying districts be adjusted to the actual demand, by turning back cars at suitable points instead of running all cars to the end of the line.

That the board of control be charged with the duty of providing good service, making frequent checks on traffic to provide the proper number and distribution of cars.

That the headway and speed of cars be improved.

That trainmen be required to exercise courtesy and forebearance toward the public.

That upon the adoption of the "service-at-cost" plan, the initial fare be fixed at a figure sufficient to pay the cost of operation plus a just return on capital invested.

That the flat fare with the universal transfer, as distinguished from the zone system, be continued.

That the present good feeling between the company and employees be fostered and continued as far as possible.

That a further study of traffic conditions and possible remedies for congestion be made.

That looping in the downtown congested district be discontinued.

That the city provide more traffic policemen.

That the company undertake an educational campaign to induce patrons to provide tickets or exact fare when boarding cars in the congested district.

That the chairman of the board of directors of the company be a Kansas City man.

The committee of one hundred was appointed on July 17, 1919, at the request of the Real Estate Board. The purpose in appointing the committee was to have an analysis of the local railway situation made by business men to determine what the troubles were that made service poor, and to see what solution of the problem could be found. The committee met and organized on July 25.

During the following two weeks a number of meetings and hearings were held by this committee, and on Aug. 5, a preliminary report was made to the committee of one hundred, in which it was recommended that because of the great amount of work necessary, various sub-committees be appointed to study special phases of the problem. For each sub-committee it was recommended that a member of the executive committee be chairman.

On recommendation of the executive committee, these sub-committees were appointed: Financial transactions, valuation, investigation in other cities, service and fares, economies and efficiency, franchise, labor, jitneys and other sources of traffic loss.

The work of these sub-committees in securing information and preparing reports, and the work of the executive committee in correlating and preparing the final report, were shown in the final report submitted to the committee at the meeting on March 5.

The final report is a 9-in. by 12-in. book of fifty printed pages. The first part of the report is given over to a summary of the findings and recommendations. Following these are the detailed data on which the final recommendations are based. The summary includes recommendations on valuation, financial transactions and financial condition, service and fares, franchise, jitneys and miscellaneous factors in railway operation.

The report and the investigations on which the committee's report is based comprise one of the most extensive pieces of work ever undertaken by the local Chamber of Commerce. The eight sub-committees, and the executive committee worked for six months getting information. This was gathered not only in Kansas City, but from various other cities in the country. A sub-committee even made a trip to several of the large eastern cities, getting detailed data on their railway operation.

Atlanta Men Strike

Ignore Their Union and Tie Up City for Three Days—National Body Withdraws Support

The city and suburban traction lines at Atlanta, Ga., were paralyzed for almost three days during the week ended March 13 as the result of a strike of union carmen employed by the Georgia Railway & Power Company. The men left their posts shortly before 5 a.m. on March 10, and remained off duty until 5 p.m. on March 12. The decision to return to work was reached at a meeting on the morning of March 12, following a refusal of the national headquarters of the union to recognize the strike and an order stating that the men should return to work at once.

On Tuesday afternoon a board of arbitration, including Luther Z. Rosser for the company and Madison Bell for the men, with Judge John D. Humphries, acting as umpire, granted the men an increase of 15 per cent over the old scale of wages. The prevailing scale was 36, 38 and 40 cents an hour, and the increase raised this scale to 42, 44 and 46 cents an hour. This was not satisfactory to the men, and in spite of their previous agreement to abide by the decision of the board, they took a strike vote and left their posts. The vote was taken at a mass meeting called on Tuesday night which lasted until morning. The vote stood 499 to 149 in favor of the strike.

During the three days of the strike no cars operated. No disorder developed. The company had taken a stand which indicated that it would not give up this time to the demands of the men. Public opinion was decidedly in favor of the company. At first it appeared that the men were equally determined not to return to work until they were granted an increase in pay considerably greater than that awarded by the board of arbitration. Doubtless they would have remained out for an indefinite period but for the fact that the national headquarters of the union refused recognition of the strike on the grounds that the union permits the settlement of such disputes by a board of arbitration. Furthermore, the men realized that public opinon was against them.

In a large paid advertisement in Atlanta newspapers the Chamber of Commerce demanded that the men return to work. The chamber declared that the men had violated their solemn word in leaving their posts. The Rotary Club of Marietta, Ga., served by the interurban system, called upon the company to leave its cars in the carhouse until it was able to operate on an open-shop basis. All this had its effect upon the men and doubtless resulted in the early settlement of the strike.

It had been stated at hearings of the arbitration board that if increased salaries were granted this would necessarily mean an increase in fares, as the company is already operating at a loss. Whether the increase granted by

the board, while it is only 15 per cent, will result in another raise in fares is still undetermined.

During the progress of the strike, retail business in the downtown district was seriously interfered with, and while means were found to bring employees to work and get them home, there was no satisfactory transportation for customers and downtown stores suffered as a result. The Atlanta Automobile Association had called upon auto owners to help out, but even so, thousands of people were compelled to walk. Railroads serving suburban towns that are also served by the electric traction lines of the Georgia Railway & Power Company put on more trains and this helped out to some extent.

It was late Saturday before the full schedules were in operation on all of Atlanta's city and suburban lines.

Railway Makes Counter Franchise Bid

Detroit Line Unalterably Opposed to Plan for Opposition System Built by City

A statement signed by President Frank W. Brooks of the Detroit (Mich.) United Railways brands Mayor Couzens' proposed piecemeal plan as "not only unfair but dishonest." The company signifies its intention to fight the Mayor's plan, and to endeavor by all legitimate means to prevent his policy from being imposed upon the company. It has also made a counter franchise proposal.

Settlement Ordinance Offered

The company's position was outlined and a plan of settlement proposed, based on the adoption of a working agreement between the company and the city. An ordinance outlining its plan has been prepared by the company, which will be immediately submitted for the consideration of the taxpayers and electors of the city of Detroit.

In his letter to the electors, Mr. Brooks states that no one appreciates more fully than the company's officials that the service they have been able to give is inadequate; that no one is as vitally interested in changing this situation and providing adequate service as they are, that the city authorities are responsible for the discomforts car riders are suffering and the inadequate service with which they are provided.

In justifying the statement that the company has availed itself of every resource at its command to improve conditions, it is pointed out that within the past ten years—and since most of the important franchises are claimed to have expired—the company has expended in betterments and extensions of tracks, equipment and facilities, upward of $13,000,000 in reliance upon the belief that in any final settlement of the railway situation, the company would be treated fairly, and its stockholders reasonably protected if the city should conclude to engage in municipal ownership and operation.

Company Willing to Sell

To this end it is contended the company, in recognition of an alleged desire on the part of the taxpayers and electors of the city to engage in municipal ownership, co-operated with city representatives to enable them to do this by offering to sell to the city the entire railway system at its fair value, and on two occasions entered into formal agreement to that end.

Reviewing the details of the plan which the company assisted in giving the electors an opportunity to ratify, President Brooks stated that in the first instance it was agreed that the fair value of what was needed by the city should be fixed by three of the Wayne County Circuit Judges, and in the second instance a fixed price was agreed upon at least $10,000,000 below the investment of the company. Mr. Brooks adds:

> These plans having failed, Mayor Couzens now undertakes to force upon the people the so-called "piece-meal" plan of acquiring a railway system, and proposes to create a second railway to engage in competition with this company To accomplish this, the Mayor proposes to dismember and cripple our system and by coercion compel us to sell important parts of our system at less than the conceded value. For instance, he proclaims publicly that the cost of construction of our Woodward Avenue and Fort Street tracks is about $70,000 per mile (it is actually $100,000 per mile) and that he will force us to sell at $40,000 per mile.

Twenty million dollars is the estimate the company puts on the cost of needed extensions, cars and equipment, and this amount can only be secured by a reasonable grant of authority to operate the system under fair conditions.

Conditions of Counter Proposal

The company filed with the Corporation Counsel a counter proposal to the Mayor's plan. This is in the form of an ordinance and provision is being made to permit the submission of the ordinance to the voters as soon as the City Council will authorize an election. This ordinance cannot go before the people at the election on April 5 as there is not sufficient time to fulfill the provisions of the city charter, and unless a special election is called, it cannot be voted on before the November election.

In the ordinance the company proposes to surrender all existing franchises and private right-of-way held by the company. Control of service will be vested in the City Council, giving the city the right to regulate the operation of the system with respect to maintenance of its tracks, frequency of service and routing, and operation of interurban cars within the city limits.

The ordinance obligates the company to begin immediately on the construction of 200 miles of extensions to the present line and to complete these extensions at the rate of 50 miles per year for four years.

Provision is also made for adding 350 new cars, comprising 200 new double-truck motor cars and 150 trailers within the first year, with 100 new motor cars and 100 new trailers to be added during each of the following three years. All obsolete cars are to be replaced with modern types.

A straight 5-cent fare with universal transfers is specified, to apply on all lines within the city, including lines now outside the single-fare zone, and is to be extended to include territory annexed to the city in the future.

The ordinance provides for the purchase or lease of the Detroit United Railway city system by the city of Detroit at any time during the life of the thirty-year agreement at a price to be fixed by the board of arbitration, the agreement to be terminated by the exercise of the city's option to purchase or by the failure of the company to carry out the program of extension.

Under the ordinance, the price for which the city shall purchase the lines or lease them at a rental of 6 per cent of the valuation, is to be decided upon by the appraisal of the board of arbitrators, this appraisal to be made immediately after the passage of the ordinance, and from year to year as long as the 6 per cent return is made.

Provision is made for the use of the Ford gas car or any other system of equipment adaptable to Detroit's needs, which can be operated more economically and efficiently than the present power system. Tracks and cars will be provided for a subway or elevated rapid-transit system when such system shall be built by the city.

A detailed description of the proposed extensions which the company shall be required to build under its terms, provided the ordinance is ratified, is attached to the ordinance.

The Detroit United Railway proposes to form a new company to take over the entire business of the city lines in order to differentiate between city and interurban accounts, the books of this proposed new company to be opened for inspection and examination at all times by city officials.

Promoters of Subways Must Explain

The street railway committee of the Council of Cleveland, Ohio, has decided to give the Cleveland, Akron & Canton Terminal Railway until April 10 to agree with the Law Director on certain changes to be made in its franchise. This company has been authorized to build a subway under East Fifty-fifth Street for the transfer of freight cars from the southern part of the city to the lake front. Law Director Fitzgerald desires so to change the franchise as to compel the company to build at a depth that will not interfere with the proposed municipal subway. The Hopkins interests were allowed one week to appear before the committee and show cause as to why their subway franchise should not be repealed.

City to Buy Buses

New York to Start With an Initial Outlay of $1,140,000 —Expects a Profit

The Board of Estimate of the city of New York has unanimously committed the city to an experimental municipal bus system. Strange as it may seem, the city voted an appropriation for buses on the same day that the receivers of the surface lines in Manhattan and Brooklyn withdrew their appeal for an increase in fare. In some quarters it is believed that buses will supplant all suspended trolley routes.

COMMISSIONER WHALEN IN CHARGE

The Department of Plant and Structures has been supervising the operation of privately owned buses over 5 routes in Manhattan since last September, in Brooklyn 7 routes since October, 1919, and in Staten Island 5 routes since Jan. 19, 1920. Through the efforts of Commissioner Whalen, of Plant and Structures, the Finance and Budget Committee of the Board of Estimate, recommended that his plan for the purchase of 200 buses be approved. On March 12, 1920, the Board of Estimate unanimously voted to issue $1,140,000 in tax notes to cover the cost of these buses. Commissioner Grover A. Whalen, who is the general manager of the municipal bus lines was directed to prepare contracts and specifications for competitive bidding for the buses, and to submit these forms together with a full description of the type, style and size of vehicles to the board as quickly as possible.

The routes on which the buses are to be operated has not yet been definitely settled, but Mayor Hylan has directed that some of the buses be sent to Staten Island for use along the routes on which the Staten Island Midland Railway suspended service last January. The motion of President La Guardia of the Board of Aldermen, however, for the city to take over the present bus route between St. George Ferry and the Army Base hospital at Fox Hills was adopted, thus overruling the contention of President Van Name of the Borough of Richmond at a recent hearing that the privilege was held by a private party who should be allowed to retain it. The route in question is approximately 8 miles long and the fare charged is 15 cents each way.

THE COMING REVOLUTION

In commenting on the action of the Board of Estimate Commissioner Whalen said:

> Their action was a great step along the line of progress. When the buses are placed in operation and the street cars and tracks eliminated from the roadways, it will completely revolutionize the city's traffic problems and will be a solution of the many difficulties occasioned by the present method of surface car transportation, which has been most aggravating to the people.
>
> The policy of the city in connection with the operation of the bus system will be one of courtesy and efficient service. It will also afford to the city an additional source of revenue which is very much needed. When the municipal bus operation becomes city wide it will relieve, in a measure, the great burden of taxation. It will also help largely to build up the sparsely occupied territory in the city.

It is estimated that the buses will cost $5,500 each, and that the operation of the 200 buses will net the city an annual profit of $275,064. Buses will seat twenty-seven passengers and operate on a 5-cent fare.

It is expected to have the buses in operation not later than May 15.

Rhode Island Legislation Probably Lost

An agreement with respect to the affairs of the Rhode Island Company, Providence, R. I., upon which legislative action can be taken at the present session seems remote. March 30 is the last day for the introduction of new business except by unanimous consent, and some of the Assembly leaders say there is no chance at this late day to take up such a big problem as is involved in connection with the affairs of the Rhode Island Company.

It will be recalled that on Feb. 24 the receivers of the Rhode Island Company presented to the Legislature a plan for state ownership and control with private operation for all lines of the company. The results which it was hoped to achieve under this plan were summarized in the ELECTRIC RAILWAY JOURNAL for Feb. 28, page 445.

Meanwhile bondholders of the United Traction & Electric Company and the Rhode Island Suburban Railway have agreed upon a plan of re-organization of the properties. The conditions of this reorganization were made public during the week ended March 13. Receivers of the Rhode Island Company have also been working on a reorganization plan. They made the details of their plan public early in the week ended March 20. Of course these respective plans are only tentative, but the terms of the plans are so different that the parties at interest would apper to be farther apart with respect to a settlement than before the plans were made public. Both plans provide for the reduction of the securities outstanding.

Contract Awarded for Power Improvements

The board of directors of the Monongahela Valley Traction Company, Fairmont, W. Va., has confirmed the action of the officials in signing a contract with the Fred T. Ley Company, contractors, for the installation of a 20,000 kw. turbine in the Rivesville power plant of the company. This addition, costing about $700,000, will make the local plant one of the largest in the South.

The turbine is now being assembled by the General Electric Company. It will be shipped to Fairmont in June. The necessary condenser equipment has been purchased from the Alberger Condenser Company. It is expected to have the new unit ready for operation by Oct. 1.

Trainmen Force Action

Binghamton Men Strike When Council Again Puts Off Granting Relief to Railway

Patience has ceased to be a virtue at Binghamton, N. Y. It took the trainmen in the employ of the Binghamton Railway some time to find this out, but when they did the men took things into their own hands and went out on strike. They didn't strike against the company. They struck against the Council, the members of which they helped to put into office. Binghamton walked while the Council talked. It walked for several days.

ROAD IN RECEIVER'S HANDS

The Binghamton Railway has had more than its share of trouble. It has been denied a square deal and is in hands of a receiver. On a 5-cent fare the company could not increase the pay of its men. It said so frankly. The men accepted the statement. The Council, however, paid no attention to the plea of the company. It persisted in watchful waiting. This policy of procrastination the men have brought to an end.

At the meeting of the Council on March 8 two ordinances were introduced, both of which aim to grant the company permission to petition the Public Service Commission to establish a 6-cent fare. Introducing a measure and passing it are two different things. The men had learned this by experience. They acted while the Council deliberated. The next morning all Binghamton walked. The men believe in a policy of live and let live. They announced they would take their chances with the company, but that they were through taking chances with the Council. They did, however, arrange to run cars at rush hours so that the working public might not be seriously inconvenienced.

At first some members of the Council were inclined to become belligerent. They threatened to withhold approval of the fare measure until the conductors and motormen returned to work. The Council soon found that in this game the trainmen held all the trumps. Only when the railway men were assured that the ordinance would be passed did they announce the cars would again be run. The present wage scale is 34 to 38 cents an hour. The new rate will probably be 41 cents to 45 cents an hour, although the men have made no fixed demands. This matter remains to be adjusted.

COMPANY PAYING THE LIMIT

There is a wage agreement in Binghamton. The company is now paying in excess of the rates prescribed, but it has gone the limit on the present fare. The men understood and appreciated this, but the Council did not. It was necessary to bring the facts home to them forcibly. The trainmen succeeded by direct action, where indirect appeal fa l d.

News Notes

City Petitioned to Take Over Railway.—M. J. Morley is conducting a campaign to induce the Mayor and Commissioners of Phoenix, Ariz., to take over the Phoenix Railway. More than 2,000 names already have been signed to the petitions now being circulated among residents and property owners.

May Retry Mr. Dempsey. — John J. Dempsey, former director, vice-president and transportation head of the New York Consolidated Railroad, Brooklyn, (N. Y.) Rapid Transit System, will probably be retried on a charge of second degree manslaughter in connection with the Malbone Street wreck. The jury in the first trial of Mr. Dempsey was unable to reach an agreement.

$1,376,341 Is Chicago's Share.—The share of the city of Chicago in the profits of the Chicago Surface Lines for the fiscal year ended Jan. 31, 1920, will be $1,376,341, according to estimates made on March 14 in the City Comptroller's office on the basis of the traction companies' monthly statements for the year. With this addition the traction fund in the possession of the city will be $27,431,841.

Union Wants Agreement Modified.—The members of the local division of the Amalgamated Association at Providence, R. I., have voted to notify the Rhode Island Company that they intend to reopen, for possible revision, the present working agreement with the railway. This agreement expires on May 31. The contract as it now stands requires ninety days' notice of a desire for its modification.

Co-operative Plan for Louisville.—Six representatives of the employees of the Louisville (Ky.) Railway and six officials of the company met recently to perfect a Co-operative Welfare Association seeking betterment of mutual interests and improvement of car service. Details of the Stotesbury-Mitten plan in operation in Philadelphia were studied and its principles adopted as the basis for the working plan of the organization.

Objection to One-Man Cars Withdrawn.—End of the opposition to the railway system in Muscatine, Ia., has come with the abrogation by the City Council of an ordinance demanding two-man car operation. The Clinton, Davenport & Muscatine Railway, operating the city lines, installed one-man cars some time ago. The city fought the one-man car bitterly at first, but has now repealed the ordinance and withdrawn its action from the State Supreme Court.

Carhouse Held Up. — More than $1,000 was taken from the Starr Avenue carhouse of the Toledo Railways & Light Company, Toledo, Ohio, when two armed bandits held up the dispatcher and receiver late Friday, March 12. The robbers came about an hour before the night run conductors turn in their funds. They unceremoniously kicked in the door and directed their guns at the men on hand, grabbed the money and whisked away in an automobile. The police have found no clues in connection with the hold-up.

Strike on Williamsville Line.—Electric railway service between Buffalo city line and Williamsville was suspended on March 3 when motormen and conductors employed by the Buffalo & Williamsville Electric Railway struck for higher wages. The men at present receive 35 cents an hour, it is said, and are seeking an increase to 50 cents. The strike does not involve more than a dozen men, but the walkout will greatly inconvenience commuters. Two cars are operated on the line during the day, and two or three more during the rush hours.

Seattle Elects New Mayor. — Hugh M. Caldwell, formerly Corporation Counsel of Seattle, Wash., has been elected Mayor of the city over James Duncan, the labor candidate, by a margin of 17,098 votes, the largest majority ever given a mayoralty candidate in the history of Seattle. Mr. Caldwell polled 50,875 votes while Mr. Duncan received only 33,777. Only 88 per cent of the city's registered strength participated in the election. Mr. Caldwell made the conduct of the Seattle Municipal Railway one of the points in his attack upon the existing city government.

Scranton Demands Refused. — The Scranton (Pa.) Railway, through Jilson J. Coleman, general manager of the company, has rejected the demands of its employees for an increase in wages of 20 cents an hour. Mr. Coleman, in refusing the increase, stated that the additional pay and the reduction in hours asked by the men would cost the company $450,000 annually. He pointed out that the company's net earnings for the year ended Dec. 31, 1919 amounted to $118,431. Wages were increased on Jan. 1, 1920, the present scale for trainmen being from 46 to 50 cents an hour.

Wage Advance in Reading. — The Reading Transit & Light Company, Reading, Pa., on March 5 announced an increase of 4 cents an hour in the wages of the 600 motormen and conductors employed over the entire system, comprising Reading, Lebanon, Norristown and Roxborough. This advance, which is the seventh to be made by the company in less than three years, increases the maximum wages of motormen and conductors from 46 to 50 cents an hour. The new scale will go into effect on March 16. Since fares were first advanced in January, 1918, the wages of the men have advanced a total of 22 cents an hour—from 28 cents to the present rate of 50 cents.

Court of Industrial Relations Suggested.—Senator White of Atlantic County has introduced a bill in the New Jersey Legislature to set up a Court of Industrial Relations to take the place of the Board of Public Utility Commissioners. The new body would be fashioned along the line of the recently created Kansas court and would handle utility and all transportation and industrial matters. The new organization is to be composed of three judges to be appointed by the Governor with the advice and consent of the Senate. The members of the court would hold office for three years. The salary would be $5,000 a year. Upon the court would be conferred the same powers that are now vested in the Public Utility Commission.

Newspaper Man Gives Live Facts.—Jonathan C. Dill has an interesting story "Are Trolley Cars Extinct?" in the Utica *Saturday Globe* for Feb. 28. It describes in a chatty way some of the things which the electric railways are "up against". One of these is not the automobile, according to an interview which Mr. Dill had with a local railway manager. In spite of the increase in the number of automobiles during the past eight years, the railway is carrying a constantly larger number of passengers. This proves that the electric railway is not obsolete or being seriously affected by automobile competition. It is only faced with the situation which every individual has had to meet, namely, increased expense. This is a serious matter when income does not go up in like ratio.

Program of Meeting

American Railroad Association

The American Railroad Association and the Railway Supply Manufacturers' Association have announced plans for the annual convention to be held in Atlantic City, June 9 to 16, inclusive. The reports of committees of Section III — Mechanical — investigating locomotive matters will be received and discussed on Wednesday, Thursday and Friday, June 9, 10 and 11, and reports of committees on car matters will be taken up on Monday, Tuesday and Wednesday of the next week. The sessions of the Mechanical Section will be held in the morning to give time for viewing the exhibits. The Purchases and Stores Section of the American Railroad Association will hold its annual meeting on June 14, 15 and 16, in the Hippodrome.

The Railway Supply Manufacturers' Association has arranged to have exhibits in the balcony over the main building on Young's pier, which will make the total exhibit space approximately 100,000 sq.ft., an increase of 6,500 sq. ft. over 1919. Applications have already been made for practically all the available booths and a large number of new companies will be represented. All entertainment features will be held on the pier, as was done in 1919.

Financial and Corporate

Net Income Increases

Dallas Interurban Company's Figures Show Prosperous Year—Some Divisions Operated at a Loss

The gross earnings of the Texas Electric Railway during 1919 amounted to $2,951,511, representing an increase of 23.9 per cent over 1918. Operating expenses and taxes increased $302,019.96, or 21 per cent over 1918.

The net income of the company after interest charges for 1919 was $735,454.68, or an amount available for dividends on preferred stock at the rate of 2.8 times the annual dividends on all preferred stock. The balance available for common stock was $476,454.68, virtually all of which has been used for increased working capital, made necessary by the higher prices of materials and for betterments and improvements of the property.

DIVIDENDS PAID

Regular dividends at the rate of 7 per cent were paid on the first and second preferred stock and an initial dividend at the rate of 0.5 per cent on the common stock for the quarter ending Dec. 31, 1919, has been declared payable March 1, 1920.

Of the six street railway systems operated by the Texas Electric Railway, Denison reported the only gain in income after depreciation values had been deducted. At that place the gross revenue was $34,647 for the year. Operating expenses and taxes were $22,286, and depreciation was assessed at $6,783, or an income after depreciation of $5,578. The gross revenue from the Waco street railway system was $341,518 for the year, with operating expenses and taxes placed at $287,404. Depreciation was given at $75,780, or a deficit in income of $21,666. The deficits at Waxahachie, Corsicana, McKinney and Sherman were given as $7,767, $6,820, $6,107 and $720, respectively.

Hudson Valley Operating at Deficit

Additional detailed evidence covering the operation of the Hudson Valley Railway, Glens Falls, N. Y., was presented to Public Service Commissioner Frank Irvine on March 12 on the company's petition for permission to charge a 7-cent fare in its different operating zones. The evidence was by D. C. Waters, auditor for the company. If no further hearing is desired the case will be closed for decision.

About fifteen statements were introduced by Mr. Waters. They covered the operation for 1914, 1918 and 1919 of the Troy-Waterford zone and the Glens Falls-Fort Edward zone, the latter divided between urban and interurban operation, and between Ballston Junction and Saratoga Springs, tolls paid over the Lansinburg-Waterford bridge, rate 2½ cents a car; rates for electric current furnished by the Mechanicville power plant and details of operation of the latter. There was an income account of the company's freight department for 1918 and 1919, and four months in 1917, the net income in 1919 being $17,565 and in 1918, $28,550.

An income statement for the last six months in 1919 showed: total revenue, transportation, $504,509; revenue from other railway operations, $33,596; total railway operating revenues, $538,105; total operating expenses, $440,931; net operating revenue, $97,173; taxes, $24,530; operating income, $72,643; non-operating income, $2,719; gross income, $75,362; deductions from gross income, $180,050. The deficit in net income available for dividends was $116,085.

Mr. Waters said operations for the first two months in 1920 showed a continuing deficit, the net deficit for January being $22,606 and for February, $31,407. There was charged for taxes in January $4,500, or one-twelfth of about $54,000.

If Providence Will Let Him

With the injunction to run the road for four months longer—"if Providence will let him"—Harrison B. Freeman, receiver for the Hartford & Springfield Street Railway, Warehouse Point, Conn., received some encouragement by Judge Lucien F. Burpee of the Superior Court of Hartford County on March 12 when the court granted the receiver permission to borrow $10,000 to meet extraordinary expenses that are being incurred by the road, the major part of the necessary money being accounted for in cost of coal and for removal of snow.

Francis R. Cooley, chairman of the bondholders' committee, supported the stand of Mr. Freeman, telling the court that the bondholders believed that the road could weather the financial storms if it got past the present trying weather.

The road has bills outstanding for the present winter of $8,023, one half of this sum being represented in coal, and it has no money to meet these obligations. The January receipts fell below expenditures by $3,671, and cost of snow removal in February pushed the operating deficit for that month to $6,840.

The railroad runs on both sides of the Connecticut, between the two cities whose names it bears and connects thirteen towns, many of which would be almost cut off from each other and the rest of the world if the trolley failed to run.

Receiver Discouraged

Forced to Suspend Operation Representative of Court Decides to Apply for Order of Sale

George Spalding, receiver of the Blue Hill Street Railway, has announced that the road will be sold for junk. The road was placed in operation on Nov. 3, 1899. It is the only route to Great Blue Hill from Mattapan Square, Boston. The road runs through Canton to Stoughton. It also connects with Sharon.

The road has never paid a dividend, but up to 1918 it was able to earn operating expenses. There are twenty-one cars, 12½ miles of track, a carhouse at Canton and a power house in the same place. The last car started over the road was reported recently to be half buried in the snow at Ponkapoag. It had been sent out on its regular run on Feb. 5.

The company shut down because of its inability to secure delivery of coal from the New York, New Haven & Hartford Railroad. The entire force of trainmen has been discharged.

Mr. Spalding was appointed receiver of the road in April, 1919. The company then had a deficit of $101,000. Despite the efforts of the receiver, he has been unable to reduce this. In fact the deficit at the present time is $110,000. The deficit in January was $7,000. There have been six zones with a 5-cent fare in each zone.

On account of its dependence on the Blue Hill Street Railway for power, the Norwood, Canton & Sharon Railway has also been obliged to close down. This little road was abandoned some time ago, but the tracks and wires were bought from a junk dealer by citizens who put the property in repair and obtained cars and power from the Blue Hill Street Railway.

Mr. Spalding says that he will apply for permission to foreclose the mortgage, but as the sale will have to be advertised four weeks before there is a decree, it will probably be some time in April before the road is finally put up at auction. If there are no bidders for the road Mr. Spalding will sell the property for junk.

F. A. Prince, a resident who helped in the purchase of the Norwood, Canton & Sharon Railway, is reported to have stated that steps will be taken to resume service on the Norwood, Canton & Sharon Railway and that the Blue Hill Railway will probably be rescued.

Cost of Cambridge Subway Declared

The cost of the Cambridge Subway has been declared by the Massachusetts Department of Public Utilities to be $7,868,000. Under the provisions of the Act of Legislature whereby the State is to buy the Cambridge Subway, $8,000,000 was set aside for purchase. Thirty days after the price certification of the subway by the State Department of Public Utilities, the tube is to become the property of the State.

Municipal Earnings Drop

San Francisco City-Owned Lines Face Difficulties Similar to Those Confronting Private Companies

The annual report of the Municipal Railway, San Francisco, Cal., for the fiscal year ended June 30, 1919, shows a gain in operating revenue over the previous year of only 1.07 per cent. But due to a 13.85 per cent increase in operating expenses, the net income for the year after deducting comparison charges required by its charter, showed a theoretical deficit of $116,000. Actually the balance was $88,965 as compared with $326,306 for the previous year. Which is equivalent to a decrease of $237,341 or 72.5 per cent in net income.

Passenger traffic as a whole fell off 4.89 per cent due to the fact that the number of free transfers collected decreased 27.50 per cent and revenue passenger traffic increased only 1.298 per cent. Schedules were also cut to some extent with this falling off in traffic and the speed of cars increased 2.66 per cent to fill the gap caused by pulling off cars.

The several comparison charges included cover services rendered by various city departments, insurance on cars, and city, state and federal taxes. The "true" net income, therefore, is greater than the comparison net income shown, by the amount of the comparison or so-called charter charges. In 1918 these charges amounted to $218,719 while in 1919 they had decreased 3.17 per cent to $211,771 due, to the fact that the net income of the company was a deficit and therefore no federal income taxes were payable.

The chief reason for the decrease in net operating revenue, as shown in the accompanying table, for the year 1919 is the increase in the cost of operation which is 13.85 per cent greater than in the previous year. This is attributed to the greater cost of labor and material and is especially reflected in the maintenance charges for equipment, which increased 54.5 per cent. Hourly platform labor charges have increased 12.5 per cent since April 16, 1919, due to an advance of 6.25 cents per hour in wages. For the year 1919, platform expense totaled $847,567, an increase of 17.18 per cent over the previous year. In reality for every revenue car-hour operated, platform service cost $1.09. The hourly wage paid is now 56.25 cents and eight hours constitutes a day's work.

Passenger revenue for 1919 increased but 1.17 per cent over 1918 due to the fact that the number of revenue passengers increased but 1.3 per cent. The average fare per revenue passenger also slightly increased because the loss in revenue from tickets used by the government and from the sale of school tickets was offset by a 14.18 per cent increase in the number of 2-cent transfer passengers and a 1.4 per cent increase in five cent cash passengers. The average fare of passengers lost was 3.3 cents as against 4.58 cents from those gained.

Some Operating Percentages

A further analysis of operating expenses indicates that maintenance and depreciation took 22.7 per cent of the operating revenue in 1919 as against 20.02 per cent in 1918. About 25 per cent of the operating expenses go toward maintenance and depreciation. The amount set aside for depreciation represents 14 per cent of the passenger revenue, and is equivalent to more than 5 per cent of the road and equipment account.

Power cost takes 13.6 per cent of the operating revenue, while conducting transportion takes 43.5 per cent. In other words, the cost of operating the cars takes practically one-half of the total amount spent. General and miscellaneous expenses, when considering all comparison charges, consumed 7.38 per cent of the total operating revenue which is equivalent to practically 8.5 per cent of the total operating expenses.

The general balance sheet shows the plant and property to be worth $6,903,758, an increase of $404,278 over the previous year. This is because of three track extensions covering 6.06 miles of single track that were made in the early part of the year 1919.

INCOME STATEMENT OF SAN FRANCISCO MUNICIPAL RAILWAY
(Includes all charges as required by charter)

Year Ended June 30	1919	1918	Per Cent Change, + Inc., — Dec.
Revenue from transportation	$2,391,176	$2,363,366	+ 1.176
Revenue from other railway operation	10,222	12,563	— 18.65
Total railway operating revenue	$2,401,398	$3,375,929	+ 1.072
Way and structures	$63,331	$49,337	+ 28.4
Equipment	147,446	95,460	+ 54.50
Power	327,687	284,433	+ 15.10
Conducting transportation	1,045,704	899,764	+ 16.28
Traffic	264	339	— 21.851
General and miscellaneous	70,612	68,305	+ 3.37
General and miscellaneous (comparison charges)	10,904	9,644	+ 13.08
Depreciation (14 per cent of passenger revenue)	334,867	330,736	+ 0.95
Accident reserve (4 per cent passenger revenue)	95,676	94,535	+ 1.21
Total operating expenses	$2,096,491	$1,832,553	+ 13.85
Net operating revenue	$304,907	$543,376	— 44.10
Taxes—(comparison changes required by charter)—			
State franchise (5.25 per cent operating revenue)	$126,155	$124,602	+ 1.248
Muncipal franchise (3 per cent passenger revenue)	71,757	70,878	+ 1.242
Muncipal car license ($15 per car)	2,955	2,955	
Federal taxes (1 per cent net income)	.....	10,640	—100.00
Total taxes	$200,867	$209,075	— 3.92
Operating income	104,040	334,301	— 68.80
Non-operating income	22,248	21,500	+ 3.48
Gross income	$126,288	$355,801	— 64.50
Bond interest	243,093	248,214	— 1.66
Net income transferred to profit and loss	* $116,805	$107,587	—208.80
Surplus at beginning of year	216,916	109,329	+ 98.20
Surplus at close of year	$100,111	$216,916	— 53.80

*Deficit.

STATISTICAL INFORMATION OF SAN FRANCISCO MUNICIPAL RAILWAY

Year Ended June 30	1919	1918	Per Cent Change, + Inc., — Dec.
Track owned and operated (miles)	58.23	56.28	+ 3.46
Track owned and operated co-jointly with United railroad (miles)	5.15	1.04	.....
Car house tracks and sidings and unused spurs (miles)	3.95	3.95	.....
Total (miles)	67.33	61.27	+ 9.90
Average total miles of single track operated at end of year	63.38	57.32	+ 10.60
Revenue car miles*	7,212,763	6,935,090	+ 5.45
Revenue car hours*	779,746	766,997	+ 1.66
Revenue passengers—			
Five-cent cash	47,524,125	46,874,775	+ 1.408
Five-cent Government ticket	69,262	110,303	— 37.32
Two and one-half cent school ticket	597,483	683,192	— 12.53
Two-cent revenue transfers	856,166	750,026	+ 14.18
Total revenue passengers	49,047,036	48,418,296	+ 1.298
Free transfer passengers	9,836,127	13,589,247	— 27.50
Free passengers, employees, police, firemen, etc	458,090	388,493	+ 17.9
Total passengers	59,341,253	62,396,036	— 4.89

*Includes bus mileage and hours.

Public Service Makes Common Payment

Quarterly dividends of 1 per cent on the common and 2 per cent on the preferred stock have been declared by the Public Service Corporation of New Jersey. According to President McCarter the electric company and the gas company now are functioning properly and making satisfactory earnings, while the railway has been allowed a rate sufficient to enable it to pay its operating expenses and fixed charges without yielding any substantial return upon the investment.

The company did not declare any dividend on the common stock for the quarter ended Dec. 31.

London Traffic Increasing

Cost of Operation of English Lines, However, Offsets Any Gain from Increased Traffic

A study of the operations for the year 1919 of the five companies, parties to the agreement under the so-called London Electric Railway Companies Facilities Act of 1915, discloses that although the traffic receipts increased £2,156,078 or 31.0 per cent the operating expenses in the same period jumped 47.8 per cent, with the result that the net income applicable for reserves, contingencies and dividends was 10.32 per cent or £115,303 less than at the close of the preceding year. The fact that the London General Omnibus Company failed to earn its operating expenses is largely responsible for this loss in net income for the other four companies, namely the Metropolitan District Railway, the London Electric Railway, the City & South London Railway, and the Central London Railway, all earned a profit for dividend distribution.

The full effect of the increases in wages since the termination of the World War, and the extra cost of materials, fuel and other supplies was not felt in 1919. The working costs in 1920 will, therefore, be considerably higher and already the companies have appealed to Parliament for the right to increase their fares. Mention of this was made in the issue of ELECTRIC RAILWAY JOURNAL for Feb. 7, page 301.

The accompanying tables give an outline of the financial operations and of the traffic of the roads in the city of London for the year 1919.

INCOME STATEMENT OF ROADS IN LONDON FOR YEAR 1919

	Metropolitan District Railway	London Electric Railway	City and South London Railway	Central London Railway	London General Omnibus Company	Total
Traffic receipts	(a) £2,131,938	£1,538,707	£314,402	£449,493	£5,242,299	£9,676,839
Operating expenses	1,128,958	1,012,397	238,714	318,945	5,480,584	8,179,598
Net receipts	£1,002,980	£526,310	£75,688	£130,548	*£238,285	£1,497,2
Miscellaneous receipts (net)	160,020	109,887	26,673	59,356	207,694	563,630
Gross income	£1,163,000	£636,197	£102,361	£189,904	*£30,591	£2,060,871
Interest, rentals and other fixed charged	336,115	290,738	47,203	46,039	108,412	828,507
Net income	£826,885	£345,459	£55,158	£143,865	*£139,003	£1,232,364
Reserve for contingencies and renewals	45,000	45,000	25,000	20,000	235,000	470,000
Dividends on guaranteed and preference stocks	(b) £124,930	126,947	42,500	21,600	.....	315,977
Total deductions	£169,930	£171,947	£67,500	£41,600	£285,000	£735,977
Surplus paid into or drawn from common fund	£656,955	£173,512	(c) £12,342	£102,265	(c) £425,003	£496,387
Amount received from common fund	£59,566	£148,916	£29,783	£99,278	£158,844	£496,387
Per cent of total	12	30	6	20	32	100
Add balance from last year's accounts	21,332	23,605	24,567	17,484	60,930	147,918
Total amount available for dividends and further reserves	£80,898	£172,521	£54,350	£116,762	£219,774	£644,305

(a) Including $566,370 from government compensation after providing for adjustments.
(b) Exclusive of dividend on second preference stock.
(c) Deficit drawn or met out of common fund.

City Wins Tax Fight

The city of Parkersburg, W. Va., has been awarded a verdict in its suit against the Kanawha Traction & Electric Company arising out of the provision that the city shall receive a certain per cent of the earnings of the company. The company held that the city was not entitled to participate in any returns from lines running into the suburbs.

The case was previously decided by the Circuit Court in favor of the city. Appeal to the Supreme Court of the State was made by the company. The Supreme Court found an error in the judgment of the Circuit Court, but it proved one that could be corrected. The modification provides that the city's percentage of the earnings should date from Sept. 31, 1913, instead of Aug. 6, 1913, $262.78 being adjusted the city for this period.

The years 1914, 1915, 1916 were used in the case and the city will collect approximately $1,000 for the period. In addition to the amount for these years a settlement will be made for the years 1917, 1918, 1919. It is expected that this settlement will net the city several thousand dollars additional.

STATISTICAL INFORMATION OF ROADS IN LONDON FOR YEAR 1919

	Metropolitan District Railway	London Electric Railway	City and South London Railway	Central London Railway	London General Omnibus Company	Total
Mileage—first track	27 825	41 03	7 325	6 825	.....	.....
second track	26 975	.....	7 325	6 764	.....	.....
Total—all tracks	70 80	.....	15 680	21 375	.....	.....
Average total miles operated	70 80	.....	15 680	21 375	400	.....
Train miles—active	4,700,398	.....	1,345,305	1,523,217	.....	.....
idle	139,623	.....	22,642	13,917	.....	.....
Total train miles operated	4,840,021	.....	1,367,947	1,537,154	.....	.....
Total car miles operated	16,868,610	25,225,196	6,726,508	6,725,389	75,431,534	130,977,237
Revenue passengers carried:						
Ordinary (cash)	(b) 94,946,736	120,848,798	28,240,792	39,500,855	673,159,709	956,696,890
Workmen	(b) 22,095,147	31,130,608	11,380,985	3,896,548	.....	68,503,288
Season	(b) 25,401,190	15,604,260	2,282,436	4,904,484	.....	48,192,370
Total passengers	(b) 142,443,073	167,583,666	41,904,213	48,301,887	673,159,709	1,073,392,548
Gross passenger revenue	£1,360,000	£1,538,707	£314,402	£449,493	£5,242,299	(b) £8,900,000
Average fare per passenger (pence)	2.29	2.19	1.8	2.2	1.87	1.99
Car-mile statistics:	s d	s d	s d	s d	s d	s d
Traffic receipts	2 6.12	1 1 47	0 11 24	1 16.03	1 4.68	1 5.76
Operating expenses	1 16 03	0 9.65	0 8 52	0 11 4	1 5 71	1 3 12
Net income	0 11 78	0 3 28	0 1 97	0 5 09	0 *4 45	0 2 26
Passenger traffic	8.48	6.6	6.23	6 25	8.92	8 22

(a) Operated by Electric Locomotive.
(b) Estimated.
* Deficit.

Carhouse and Cars Burned

Loss estimated at between $50,000 and $60,000 was caused by the burning of the carhouse of the Danbury & Bethel Street Railway in Danbury, Conn., on March 16. Nineteen cars were destroyed.

Financial News Notes

Would Sell Part of Road.—Receiver Robert W. Perkins has applied to the Superior Court at New London, Conn., for permission to sell so-called deadweight sections of the Shore Line Electric Railway.

Mr. McRoberts a Monongahela Director.—Samuel McRoberts, prominent New York banker, has been elected to the board of directors of the Monongahela Valley Traction Company, Fairmont, W. Va., to succeed the late Jere H. Wheelwright, who died in France last January.

To Extend Sales to Public.—Stone & Webster, Boston, Mass., have begun in some localities the offering of new issues of securities to the public served by the utility in question. It is planned to extend the scope of this work in the future as new capital requirements arise or other occasion warrants.

Notes to Cover Paving Cost.—Declaring that it is unable to pay $25,204.63 in cash for its share of the paving on Juniper Street in Atlanta, Ga., the Georgia Railway & Power Company has petitioned the Railroad Commission for approval of the execution and issuance of three promissory notes of approximately $6,301.16 each, dated on or about March 13, 1920, and payable to the city of Atlanta one, two and three years after date, with interest at 7 per cent.

Charter Amended. — An Amendment has been filed to the charter of the Louisville (Ky.) Railway. It provides that the affairs of the company shall in the future be managed by a board of directors of not less than five nor more than fifteen members. One member shall be the president and all members must be stockholders, under the amendments. This is in accordance with plans for charges in the personnel of the company referred to recently in the ELECTRIC RAILWAY JOURNAL.

Inventory Filed in Fare Case.—The Omaha & Council Bluffs Street Railway, Omaha, Neb., has filed with the State Railway Commission an inventory in compliance with the order of the commission. This inventory does not carry any valuations. The company is, however, working on a valuation which will be filed with the commission when completed. The inventory and the valuation are in connection with the 7-cent fare which was allowed the company last summer. The increase in fare went into effect about Aug. 10 of last year. It is still in force.

State Valuation Commission Suggested—Senator Collins B. Allen, of Salem, N. J., has introduced a bill in the New Jersey Legislature for the establishment of a commission composed of the Governor, Treasurer and Comptroller for the purpose of making an independent valuation of electric railway property. The measure carries with it an appropriation of $100,000 and permits the Commission to employ electrical and mechanical engineering firms to perform the work. It also empowers the commission to examine the books of the companies as a basis for rate making.

Ordered to Resume Service. — The Board of Public Utility Commissioners of New Jersey has issued an order directing the Public Service Railway, Newark, N. J., to improve the condition of the tracks and roadbed on Main Street, Moorestown, N. J. by June 30. The company is also directed to resume the same service it operated previous to discontinuing operation some time ago, owing to the condition of the tracks the railway last November discontinued operation and failed to provide for transportation of patrons upon cars of the Burlington County Transit Company.

San Francisco Reorganization Approved.—Announcement has been made that the California Railroad Commission has approved plan of reorganization for the United Railroads of San Francisco, submitted by the committee of holders of first mortgage four's, 1927. Under the plan of reorganization the new company will be called the Market Street Railway and the 4 per cent certificate holders will receive 15 per cent of par value in first mortgage bonds of reorganized company; 50 per cent in 6 per cent prior preference cumulative stock; 5 per cent in first preferred 6 per cent stock; 10 per cent second preferred stock; 20 per cent common.

New Trustee at Dallas.—The Dallas (Tex.) Railway announces that the Equitable Trust Company, New York, has been appointed trustee to fill the vacancy caused by the resignation of the Scandinavian Trust Company, appointed trustee under a mortgage and deed of trust given by the railway on June 15, 1918, securing an issue of notes issued by it and designated as its secured gold notes. These notes were issued in the refinancing of the company in connection with the carrying out of its program of improvements and betterments pledged under its service-at-cost franchise granted by the city of Dallas.

Dallas Doing Better. — The Dallas (Tex.) Railway shows a net return of 5¼ per cent on invested capital of $8,771,905, according to figures for February given out by Richard Meriwether, vice-president and general manager. Cars of the company in Dallas carried more than 4,500,000 people, of whom 639,362 or 13.4 per cent, were transfer passengers. Cars traveled a total of 575,530 car-miles, and trainmen worked a total of 62,872 car-hours. The average number of passengers carried per mile was 8.2, and the average miles traveled by each car was 9.1. Gross earnings for the month amounted to $218,725. The operating expenses were $180,628.

Abandonment Petition Allowed.—The Public Service Commission for the Second District of New York has granted the petition of the Chautauqua Traction Company approving a declaration of abandonment of its line from Westfield to Barcelona, about 1 mile long. The commission's order follows an investigation by Chairman Charles B. Hill, who in a memorandum, shows that the line has always run at a heavy loss in operation, the loss reaching several thousands of dollars each year. The objection was raised that because of certain provisions in consents by local authorities the company has no legal right to abandon under section 184 Railroad Law, and that the section, so far as it assumes to extend that power to the company, is unconstitutional. This is not sustained by the commission.

Seek to Have Service Restored.—At a hearing on March 15 before Deputy Public Service Commissioner Morgan T. Donnelly an attorney for the receiver of the New York Railways stated that the service had been discontinued on the Eighth and Fourteenth Street lines by direction of Federal Judge Mayer, but that the receiver would be willing to consider any reasonable suggestion which could be made for the operation of service, provided the service could be rendered at less than ruinous loss. The hearing was adjourned to March 22. In the meantime the commission will engage in negotiations to determine if it is not possible to work out a plan for resumption of service. The lines cut off on March 6 were the Eighth Street, Fourteenth Street, Fourteenth Street-Tenth Avenue and the Fourth and Madison Avenue Lines. Substitute service on two of the lines —the Eighth and Fourteenth Street routes—was furnished by motorbuses which are being supplied and operated by the city.

Rainier Line Rejects City's Appraisal.—Figures on which it is proposed to base negotiations for the purchase by the city of the Seattle & Rainier Valley Railway have been submitted to the utilities committee by Councilman W. H. Moore of the Council of Seattle, Wash. Mr. Moore's report, places a value of $765,760 on the property. This does not include a sum the company spent in raising the tracks and filling the right-of-way to the present grade. Councilman Moore said he considered it a legitimate item of the valuation and the report was accepted with the understanding the sum would be added as soon as it could be estimated. Councilman Moore was authorized by the Council to make an appraisal of the line after residents of Rainier Valley had filed a petition asking the city to purchase the property. The figures were telegraphed to E. W. Sampsell, president of the company, at Chicago and a reply stated emphatically they would not be considered.

Traffic and Transportation

Fare Petitions Withdrawn

Three New York Companies Give Up Hope of Aid from Board of Estimate —Inquiry to Continue

Despairing of obtaining financial relief at the hands of the municipal authorities, three of New York City's traction lines on March 12 withdrew their petitions to the Board of Estimate and Apportionment for an increase in fare. The companies thereby ceased to be voluntary participants in the boards inquiring into the city's transit system. Nevertheless, Corporation Counsel Burr announced on March 13 that the board would continue its investigation.

The notices of withdrawal of the applications were signed by Henry L. Stimson, counsel for Job E. Hedges, receiver of the New York Railways; James R. Sheffield, trustee of the Interborough Consolidated Corporation, the holding concern of the Interborough Rapid Transit Company and the New York Railways, and Lindley M. Garrison, receiver of the surface, elevated and subway lines of the Brooklyn Rapid Transit Company. No notice was served by the Interborough Company, because the inquiry into its affairs by the board is ended, and because it is not bankrupt. It was stated that if the board reopened its inquiry into this company that it also would notify the board that it was not seeking any financial help from the board.

JUDGE MAYER TAKES ACTION

In withdrawing the petitions for relief, the receivers acted upon instructions from Federal Judge Mayer, who has charge of the companies' affairs. Colonel Stimson sent the following letter to Mayor Hylan:

MAYOR JOHN F. HYLAN,
Chairman of the Board of Estimate:

Sir: By direction of Judge Mayer of the United States District Court, I beg to inform you that I shall not participate in any further hearings before your board upon the subject of the affairs of the New York Railways. By the same direction the petition filed with you on Jan. 7, 1920, by Mr. Hedges, as receiver of the company, is hereby withdrawn. Such further investigation into the affairs of that company as your board may desire to make will not be attended by counsel for the receiver.

HENRY L. STIMSON.

Two-and-one-half months have passed since Judge Mayer directed the receivers to apply to the board for a temporary fare increase. As yet the board has given no indication of an intention to aid the companies. Although numerous hearings have been held there has been little progress in the direction of fixing a valuation of the lines.

Representatives of the companies, in testifying at the traction inquiry, have frequently been taunted with unfairness and otherwise heckled by city officials, including the Mayor. It is believed that this badgering had much to do with Judge Mayer's decision.

The board at its session on March 19 decided definitely to continue the inquiry. Mr. Burr declared that he thought the city would have no trouble in proceeding with the investigation since, under a resolution of the board, he was empowered to issue subpoenas, if necessary. The Public Committee on Transportation presented a request that the board designate a committee to confer with representatives of the security holders with a view to arriving at a solution of the traction problem.

Corporation Counsel Burr on March 17 asked the Public Service Commission to notify the Interborough Rapid Transit Company that, unless it takes immediate steps to improve its service, the city will take steps to seize and operate the company's subway lines at the end of ninety days. The terms of the subway contract give the city the right "to enter upon and as agent of the lessee, to operate the railroad and equipment * * * at the rate of fare and in the manner provided in the lease for the remainder of the term." Mr. Burr charged that the quality of the service justified the city in carrying out this provision.

$6,000,000 Houston Value

Special Master Holds Texas Property Is Denied Fair Return Under Five-Cent Rate

The Houston (Tex.) Electric Company can not earn a fair return on its property valuation with the present fares at 5 cents for adults and 2½ cents for children. This is the finding of Otis K. Hamblin, special master, appointed by Federal Judge J. C. Hutcheson to hold hearings and fix the valuation of the company's property and report on the adequacy of the return earned by the company.

Judge Hamblin in his report submitted to Judge Hutcheson places the valuation of the company's property at $6,000,000. He further reports that the company is now earning only 1½ per cent on its property valuation over a depreciation of 4½ per cent, and concludes that this rate of return is inadequate and is in effect confiscatory. Judge Hamblin says the company should be allowed a return of 8 per cent on its valuation of $6,000,000.

MAYOR FAVORS 6-CENT FARE

Mayor A. E. Amerman said he believed that a 6-cent fare would provide a fair return, and that the fare litigation would probably be ended. The Mayor doubts, however, if the 6-cent fare will prove adequate if the city demands improvements in service and facilities.

Judge Hutcheson will review the findings of the master in chancery at an early date. It is expected he will approve the report. If he does this city authorities and officials of the company will confer and if possible reach agreement on improved service and facilities and also on a higher fare than 5 cents.

Luke C. Bradley, district manager for the Stone & Webster Company, which operates the property, said the people of Houston were not getting the service the city deserved because the 5-cent fare was inadequate and the company was being starved to death. The authorized earning of 8 per cent, as proposed in the report of Judge Hamblin, and future fares to be charged by the company depend much on the co-operation of the people of Houston and the company, he said.

CASE LONG IN COURTS

The litigation between the city and the company has been before both the State and Federal courts. The company in its original petition to the City Council to increase fares represented that fares then authorized were inadequate and would not afford a fair return to the company. After extended hearings, the City Council passed an ordinance authorizing fares of 6 cents for adults and 3 cents for children.

This ordinance was attacked by the organized labor interests of the city, and under the initiative and referendum provisions of the city charter, a petition to refer the ordinance to the people for ratification was circulated and the required number of signers secured. At the referendum election the ordinance was rejected. Thereupon the company appealed to the State courts, alleging that the repeal of the ordinance was accomplished through illegal means. The company lost this fight.

APPEALS TO FEDERAL COURT

The company next brought suit in the Federal District court, representing that its property was being confiscated by the low fares authorized by the city, and asking that the court fix valuation of its holdings to be used as a basis for fixing fares. Judge Hutcheson then appointed Judge Hamblin to hold hearings and fix a just valuation and a fair return.

Judge Hamblin explained that the valuation of $6,000,000 had been arrived at after exhaustive investigation in which representatives of the city, of the company, disinterested engineers and valuation experts had been heard.

In the hearings Lamar Lyndon, valuation expert, set the value of the company's properties at $5,300,000. The special master increased this figure by $700,000.

Parking Dead Line in Los Angeles

Ordinance Effective on April 10 Will Relieve Congestion in Business District—Three Zones Established

A "no-parking" ordinance will go into effect in the business district of Los Angeles, Cal., on April 10. Under it the parking of automobiles and other vehicles will be prohibited within certain areas, and within others will be restricted to a definite period of the day. The elimination of parking within the congested area will leave the streets clear for the operation of electric cars.

Adoption of some form of restriction on the operation of vehicular traffic is generally conceded to be the only hope of relieving the transportation system in Los Angeles. Portions of the Los Angeles business district are considered the most congested areas of the sort in the entire country. The Los Angeles Railway and the Pacific Electric Railway are physically unable, because of vehicular congestion, to operate their cars on schedule.

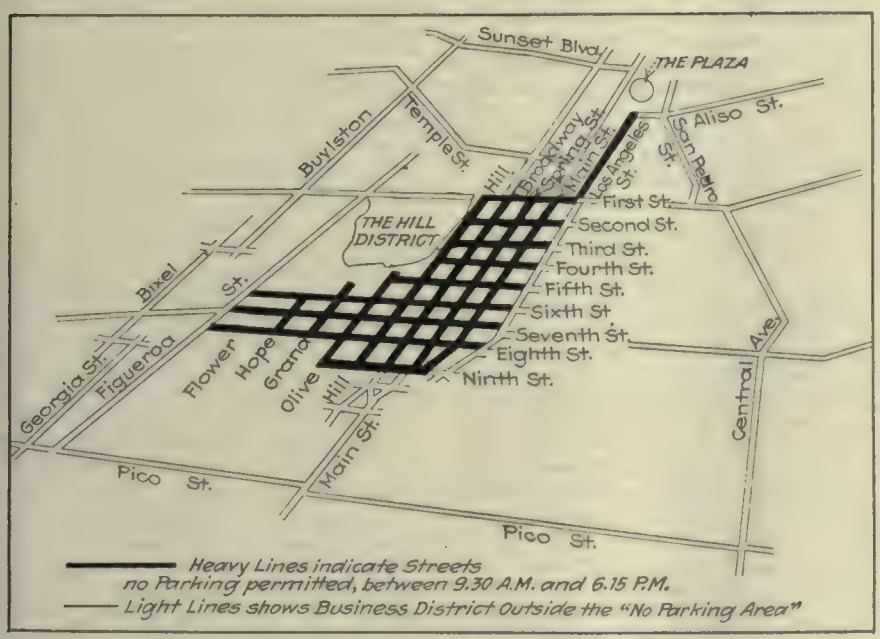


DIAGRAM OF LOS ANGELES PARKING PLAN

Commission's Recommendations

The State Railroad Commission, after an exhaustive study of traffic conditions in the city, recommended enactment of drastic anti-parking legislation and a general rerouting of cars. Acting on the commission's recommendations the City Council recently passed an ordinance, effective on April 10, under which the operation of vehicles within the business section will be controlled. The ordinance divides the business district into three zones, a "congested" or closed district, a semi-restricted section, and an unrestricted area.

Within the first of these the parking of automobiles is prohibited between the hours of 11 a.m. and 6.15 p.m. This district is bounded as indicated in the accompanying illustration. Certain street-sections in the hill region are exempted from the parking ban. Outside of this "congested" area, but still within the business district proper, is a section in which the automobilist may park his car for a period of two hours without interference from the police. This section is bounded on the north by Sunset Boulevard, on the east by San Pedro Street and Central Avenue, on the south by Pico Street and on the west by Georgia, Bixel and Buylston Streets.

Beyond these limits unrestricted parking will be permitted. The new ordinance also prohibits the use of the "left-hand turn" during the no-parking hours. Commercial deliveries are to be made from alleys whenever conditions permit.

The enforcement of these rules is expected to react on the electric railways in two ways. First, it will speed up operating schedules. At present 30,000 automobiles park in the congested district each day. Their elimination will remove the greatest obstruction to the fast operation of cars.

More Railway Riders

Second, the prohibition of parking in the heart of the city will turn a considerable volume of traffic now taken care of in other ways to the Los Angeles Railway. The number of persons daily entering the congested district in automobiles is estimated at 82,000. Since these riders may not leave their machines in this district while they are attending to their business or pleasure, the vast majority of them will either seek other parking accommodations, such as garages, park their cars at the beginning of the closed section and walk in, or leave them at home. In any case great numbers of these autoists will use the trollies.

The company will thus be confronted with a daily increase in the number of riders of approximately 80,000. To meet the new conditions the railway plans to provide additional equipment. It will also be in better shape to carry the additional burden since it will be able to operate its cars on a faster schedule. In this connection it plans to reroute its cars and to make other operating changes proposed by the commission. These latter measures will become effective on May 1. It is estimated that when the new system is in full swing the company can operate its equipment with one-half the present headway.

Referendum Proposed

The carrying out of the no-parking plan will in all probability alter the course of the city's development. It may lead to the growth of new shopping and theater districts to cater to automobilists. The plan has encountered considerable opposition at the hands of motorists. More than 15,000 persons have signed petitions for a referendum on the question of retaining the parking regulations.

Several large garages are being erected within the no-parking area. One of these has already been completed. Another is to be put up immediately at a cost of $650,000 and, when finished, will provide parking space for 1,032 vehicles.

Safety Bonus Plan Working Well

Results of the first month's trial of the safety bonus plan, recently adopted by the Dallas (Tex.) Railway as a means of encouraging efficiency and carefulness on the part of its employees, have proved most satisfactory. Richard Meriwether, vice-president and general manager of the company, reports that all but forty-two out of the total of 553 trainmen in the company's employ eligible to participate in the system, came through the month with perfect service records, and that 508 received the additional 2 cents an hour as bonus for perfect records.

Data on the bonus plan, as submitted by Charles Swenson, superintendent of transportation, to Mr. Meriwether, indicated that almost one-half of the trainmen who failed to receive the bonus, lost this extra pay through reporting late for duty. One motorman lost the bonus because he operated his car faster than the schedule called for. Seven trainmen were not awarded the bonus because of collisions, and one motorman lost the bonus because he turned back without orders and talked to a woman while on duty.

The safety bonus plan was announced by the company to take effect on Jan. 1. It will be continued for three months as a test. At the end of that time the company will probably announce the general results.

Seven Cents in Auburn

This Rate Will Prevail for Three Years —Commission Declares Six-Cent Fare Inadequate

The Public Service Commission for the Second District of New York on March 9 directed that for a period of three years, unless changed by order of the commission, a 7-cent fare shall be the maximum fare which may be charged by the Auburn & Syracuse Electric Railroad on cars within its Auburn, N. Y., zone, including all lines within the city and between Auburn and Owasco Lake and between Auburn and Soule Cemetery. The new fare becomes effective on three days' notice.

The company has been operating under a 6-cent fare since Dec. 31, 1918, and on Jan. 13 the city waived fare restriction in certain franchises so as to permit further investigation and a fare not to exceed 7 cents.

Commissioner Frank Irvine, in a memorandum accompanying the order, reviews the evidence on the hearing. He says:

> This shows a deficit from railroad operation under the 6-cent fare of $1,929, a deficit after paying taxes of $11,598 and of income applicable to capital investment of $6,932. Interest on bonds is not deducted. On the face of this showing no inquiry into value of the property is necessary. The city system is of very considerable extent and the equipment seems adequate and in good condition. It is certainly entitled to earn some return and more than can be hoped under present conditions even from the proposed increase in fare.

The city's waiver provides that the city within three years may make application for a reduction in the rate. Commissioner Irvine in conclusion says:

> It may not be amiss to repeat an admonition given already to some other companies under similar conditions; that is, that as there seems now to be no prospect of early return to conditions formerly considered normal in finance and prices, the best efforts of the company should be given to devising means of reducing expenses without impairment of service. Not that the commission deems the present expenses excessive as compared with other systems operating under present methods; they are not so; but because it is felt that some improvements in the methods themselves are imperatively necessary.

Important Freight Interchange

The Northwestern Elevated Railroad, Chicago, has purchased two new 50-ton electric locomotives which will be equipped with Westinghouse 567 motors. These are the same type motors which were specified for part of the last all-steel cars bought by the Elevated Lines.

The two locomotives will be used in connection with the interchange of freight between the Chicago, North Shore & Milwaukee Railroad and the Chicago, Milwaukee & St. Paul Railroad. North-bound freight received from the steam road at the interchange yard which lies between Irving Park Boulevard and Wilson Avenue will be hauled over the elevated structure from this point to Evanston and sent north over the North Shore Line.

Three steam locomotives are now kept busy in hauling this freight over the elevated structure paralleling the Northwestern "L" to the present interchange point in Evanston. The Elevated company will take over the handling of this interchange freight between Wilson Avenue and Evanston on Oct. 1.

Many Routing Changes Suggested

The executive committee of the Louisville (Ky.) Railway is being flooded with petitions of merchants for changes in present routings, and also of residents of certain sections of the city. Merchants are anxious to reroute some of the East and West lines and one or two North and South lines around a downtown loop. It is held that this would eliminate many transfers and give better service. However, a similar plan of a few years ago did not prove satisfactory, and the new plan would call for building some three or four blocks of additional line in the business district, as well as connections in other sections of the city. F. A. Sager, who has been employed by the railway to aid it in solving various problems, has taken all of these suggestions under advisement. The company is not likely, however, to go to the expense of building additional trackage which would probably further slow up traffic.

New York Transfer Charge Upheld

The attempt of the City of New York to restore free transfers on the lines of the New York Railways by abolishing the 2-cent charge allowed by Public Service Commissioner Lewis Nixon, was defeated on March 16, when Justice Greenbaum of the Supreme Court granted the motion of Terence Farley, counsel to the commission, to quash the writ of certiorari obtained by Corporation Counsel Burr.

The action of the court was an answer to statements made by Mayor Hylan, Mr. Burr and other representatives of the city government that Mr. Nixon exceeded his authority in permitting the transfer charge, and that it was in effect an increase of fare which the Court of Appeals had decided could not be allowed by the commission without the consent of the Board of Estimate.

Justice Greenbaum explained at length the rights retained and granted by the city under the franchises of the company, and in reference to the order of the commission said:

> It is plain from the reading of the order that in permitting a 2-cent charge for transfers no rights of the city are affected thereby.

The opinion refers to various valuations of the railway to show the need the company had of an increased income, and referred to the fact that the city had conceded the right of the commission to grant the company the privilege of charging for transfers at fourteen out of the ninety-nine points where a charge was allowed.

The privilege of the company to charge for transfers at ninety-nine of the 113 transfer points is to run only for one year, when the commission will decide whether to extend the time or restore the free transfers.

Transportation News Notes

Would Abolish Freight Service.—The West Virginia Traction & Electric Company, Wheeling, W. Va., has applied to the State Public Service Commission for permission to discontinue freight service on its line between Wheeling and West Alexander. The company asserts that to continue such service it would require additional equipment.

Must Segregate Negroes.—The South Carolina Railroad Commission has ordered the Augusta-Aiken Railway & Electric Corporation of South Carolina, Augusta, Ga., to install separate compartments in its cars for the accommodation of negroes. The commission directs the company not to operate its cars in South Carolina without segregating the races.

Seven Cents in New Castle.—The Pennsylvania Public Service Commission has authorized the Pennsylvania-Ohio Electric Company, Youngstown, Ohio, formerly the Mahoning & Shenango Railway & Light Company, to charge 7-cent cash fares on its New Castle (Pa.) city lines. The company is ordered to sell six tickets for 40 cents and twenty school tickets for $1. Under the order the new rates became effective on March 14.

Increase on Fall River Line. — The Massachusetts Department of Public Utilities has authorized the Union Street Railway, New Bedford, to increase the fare between New Bedford and Fall River from 20 cents to 25 cents. The company, which operates over the tracks of the Eastern Massachusetts Street Railway in Fall River, had temporarily discontinued service within the limits of the latter city because of the demand of the Eastern Massachusetts Street Railway management that it charge 10-cent fares in Fall River.

Six-Cent Fare Stands.—The Memphis (Tenn.) Street Railway has reached an agreement with the City of Memphis whereby it will continue to charge a 6-cent fare for three months from April 1. If at the end of that time the company is still in need of additional revenue the fare will automatically advance to 7 cents. The State Railroad & Public Utilities Commission, which has had the company's application for a rate increase under consideration, has approved the agreement.

Rerouting in Pittsburgh.—In an effort to improve spacing between cars using Forbes Street, the Pittsburgh (Pa.) Railways has announced new routing for several of its lines. In a statement explaining the changes, the company declares that since the num-

ber of riders has been increased the matter of spacing is much more important now than it has been in the past. This is the most important route change made by the Pittsburgh Railways in many years. It is expected to go a long ways toward helping to solve Pittsburgh's trolley transportation problem.

Interurban Increase Protested. — Mayors Morris of New Albany, and Myers, of Jeffersonville, have filed protests with the Interstate Commerce Commission against an increase of cash fares from 7 cents to 10 cents between Louisville and New Albany over the line of the Louisville & Northern Railway & Lighting Company. The company has arranged to sell ticket books at the rate of 7 cents a fare, with cash fares 10 cents. The increase becomes effective on April 3, unless the schedule filed is suspended within thirty days by the Interstate Commerce Commission.

Surplus Accident Fund Divided.— An average of about $50 a man for those who were in the company's service all of 1919 was paid recently by the San Diego (Cal.) Electric Railway when the surplus in the accident fund for 1919 was distributed. There was $10,369 in the fund after all claims for injury or damage to property had been paid. This was distributed to the men pro rata, based upon the number of hours worked. The policy of distributing this fund each year was adopted by the company several years ago to make the men careful to avoid accidents. It has accomplished this result, according to the officials. Most of the accidents that did occur were caused by automobiles, it was stated.

Demand for Service Improvements.— A demand that the Public Utilities Commission of Illinois take immediate action to improve service on the Chicago Surface Lines was made in a public statement issued by Attorney General Brundage on March 10. The State officials urged the extensions of "turnback" service on some of the lines which now use loops in the congested district; the installation of trailers to add to seating capacity, and the use of all available cars in the rush and non-rush hours. The commission replied with a statement to the effect that all these suggestions had already been presented to that body and were being considered.

Changes in Albany Southern Tariff. —The Albany Southern Railroad, Hudson, N. Y., under changes in its tariff, filed with the Public Service Commission for the Second District, proposes as effective on April 5 these changes: Local one-way fares increased from 8 to 11 cents from Prospect Heights to East Greenbush; reduced from 33 cents to 30 cents from Schodack Center to North Chatham; increased from 36 cents to 39 cents from Merchants to Albany. Rules relating to commutation tickets will provide that in case the sale price of a ticket is lawfully changed before expiration, the ticket will not be honored for transportation but the unused portion will be redeemed.

Municipal Operation for Staten Island.—Grover A. Whalen, Commissioner of Plant & Structures of New York City, has announced that the city authorities will take over and operate the lines of the Staten Island Midland Railway, Richmond Borough. The company suspended operation last January following the refusal of the Board of Estimate to grant it an increase in fare. Commissioner Whalen stated on March 13 that, acting under instructions from Mayor Hylan, he had practically completed arrangements for the purchase of twenty cars from the Emergency Fleet Corporation for use on the Midland Company's tracks, the latter company having transferred its own rolling stock to the lines of the Richmond Light & Power Company. The Richmond County Grand Jury is at present investigating the situation.

More Safety Cars for Terre Haute.— The Terre Haute Traction & Light Company, Terre Haute, Ind., has placed an order for ten additional safety cars for use in Terre Haute. This brings the total number of safety cars purchased by the company up to sixty-six and will provide for 100 per cent safety-car operation, including rush-hour service. All sixty-six cars are of identical design and equipment, this fact being of great importance from the viewpoint of low maintenance costs because of the complete standardization. The purchase of the last ten cars was financed in Terre Haute. Three local bankers were induced to purchase the cars, the company obligating itself with five-year 6½ per cent equipment notes. The bankers will pay for the cars when delivered and will give the company a bill-of-sale for them when it has met its obligations. The attitude of the public and the newspapers on the one-man cars in Terre Haute was the subject of an article in the ELECTRIC RAILWAY JOURNAL for March 6, page 495.

Favor Higher Tube Fare.—Resolutions favoring an increased fare on the lines of the Hudson & Manhattan Railroad, New York, N. Y., have been adopted by the directors of the Chamber of Commerce of Jersey City, N. J. The company, which operates the tubes under the Hudson River, has notified the Interstate Commerce Commission of its intention to raise fares to 8 cents on April 4. The 8-cent fare is expected to yield additional revenue to the amount of $1,000,000 per year. On the basis of the 1919 figures, which showed a deficit of $1,301,753 in the net available income to meet interest on bonds, the company still would not be meeting this item in full. Oren Root, president of the company, recently announced that although the gross revenue of the road had increased 64.82 per cent in the years from 1915 to 1919, the cost of maintenance and operation had risen in the same period 135.20 per cent. The cost of operation per car-mile increased from 18.21 cents in 1914 to 37 cents in 1919.

New Publications

McGraw Electric Railway List

For February, 1920, 284 pages, published by the McGraw-Hill Company, Inc., New York.

The issue for February of this well-known semi-annual list has just been published. As usual, it contains the names of all operating electric railway companies and municipal lines in the United States and its insular possessions, also in Canada, Mexico and the West Indies. A list of officers and a brief enumeration of the equipment are included. In this edition, which has been completely revised, are represented approximately: 1,450 changes in personnel, 650 changes in power plant and substation equipment, 500 changes in mileage and rolling stock, 500 additional miscellaneous changes, 44 receiverships, 15 re-organizations and other valuable statistics on the industry.

Commercial Research: An Outline of Working Principles

By C. S. Duncan, Ph.D. The MacMillan Company, New York, N. Y., 385 pages. Price $2.25.

It is sometimes easier to accomplish progress by warning people of impending danger of falling behind in the race than by appealing constructively to man's better nature. As Mr. Steinmetz prophetically said during the progress of the war: "Whichever side emerges victorious, all nations must of necessity adopt better standards of business and scientific organization as a matter of self-preservation."

As Mr. Duncan says, trade persists through multifarious social and political changes. The new age, like the old, will be built on a foundation of commerce. What this commerce is to be, what rules of the game are to be adopted, what organization for trade will result, what prevailing spirit will animate it, are points of vital interest.

"Commercial Research" contains a discussion of scientific principles for the solving of commercial problems, and is a guide to their application. In everyday, untechnical language there are stated the devices by means of which the manager may most quickly and accurately visualize his problems; the need for research; character of commercial research; sources of business facts; methods of collecting them; their nature, analysis, presentation, interpretation, and organization for research.

All this material is intended for education and especially for the self-education of those already in the midst of the game. There is to be found here a discussion of principles and not of historical development. The book is written for the business man; for his use and not for his entertainment.

Personal Mention

J. C. Nelson in Command

Made Head of Empire State Railroad, Succeeding the Late H. S. Holden —L. L. Odell Promoted

J. C. Nelson, vice-president and general manager of the Empire State Railroad, Syracuse, N. Y., was elected president of the company at the meeting of the board of directors on March 9. Mr. Nelson succeeds the late H. S. Holden. At the same time L. L. Odell was elected assistant general manager. Mr. Odell will continue in his capacity as treasurer.

Mr. Nelson has been in charge of the company's affairs since the death of Mr. Holden in November, 1918. Since



J. C. NELSON

that time the office of president has been vacant. The Empire State Railroad, which took over part of the system of the Empire United Railways, sold under foreclosure, operates 80 miles of track in the central part of New York State, including an interurban line connecting Syracuse and Oswego and the city lines in Oswego and Auburn.

Mr. Nelson was graduated from the University of Alabama with the degree of civil engineer, later taking a special engineering course at Cornell University. In the year 1902 he became connected with the engineering firm of Ford, Bacon & Davis, New York, with which he was associated for a number of years. He was at first employed in the construction department in connection with the development of the firm's properties in the South, and was later transferred to the New York office, where he was engaged on construction and valuation work. He also made several investigations of public utility operation.

He was appointed general manager of the Gary & Interurban Railroad, Gary, Ind., in 1916. From Gary he was transferred, in the following year, to Syracuse, as general manager of the Empire United Railways. When this company was reorganized in October, 1917, Mr. Nelson became vice-president and general manager of the Empire State Railroad, its successor. In March of last year he was elected vice-president and general manager of the Ithaca (N. Y.) Traction Company, continuing his connection with the Syracuse company.

Municipal Railway Head Quits After Election

Thomas F. Murphine, director of public utilities of Seattle, Wash., and superintendent of the Seattle Municipal Street Railway, resigned on March 16. R. M. O'Brien, assistant superintendent, has been placed in charge of the public utilities department, while D. W. Henderson, superintendent of transportation, has been given temporary direction of the municipal railway.

Mr. Murphine became the active head of Seattle's extended municipal railway system, with its trackage of more than 225 miles, in April, 1919, when the city completed the purchase of the railway lines of the Puget Sound Traction, Light & Power Company. He was formerly superintendent of the 18-mile municipal railway line which the city had installed. He was graduated from the University of Washington in 1898 with the degree of A.B., and from the School of Law of the same institution in 1907. He was a member of the 1913 and 1915 sessions of the State Legislature, where he was a leader of the Progressive and municipal ownership forces. In 1918 he was appointed superintendent of public utilities by Ole Hanson, then Mayor of Seattle, during whose administration the transfer of the railway to the city was arranged.

David W. Henderson, who has been placed in charge of the municipal lines, has been superintendent of transportation since April, 1919. Until that time he was head of the transportation department of the Puget Sound Traction, Light & Power Company. He had been connected with the latter company for seventeen years.

The recent municipal elections resulted in the choice of Hugh M. Caldwell as Mayor of Seattle. During the campaign Mr. Caldwell condemned the public utilities department and municipal railway. He was elected by an overwhelming majority. The new executive is reported to be preparing to separate the municipal railway from the public utilities department and to place the former in charge of a superintendent of transportation.

R. I. Todd Honored

Chosen President of Central Electric Railway Association—His Career as Railway Operator

Robert I. Todd, president and general manager of the Indianapolis (Ind.) Street Railway and the Terre Haute, Indianapolis & Eastern Traction Company, was chosen president of the Central Electric Railway Association at the annual meeting of that body at Louisville, Ky., on March 10 and 11. Mr. Todd's election was noted in the ELECTRIC RAILWAY JOURNAL for March 13. Mr. Todd has been associated with the work of the Central Association for many years and has already served as first vice-president, but could not be induced to accept the presidency until this year. He has now taken the office reluctantly, but has pledged himself sincerely to do his utmost in promoting the interest of the member companies.

Mr. Todd was born on Nov. 29, 1869, at Lakewood, N. J. He received the



R. I. TODD

degree of electrical engineer from Johns Hopkins University in 1893. His connection with the railway field began while he was still a student at the university, his summers being spent in the employ of the traction company at Raleigh, N. C., one of the earliest electric lines in the country. Subsequently he became connected with the Washington, Eckington & Soldiers' Home Railway, Washington, D. C., which was later consolidated into the City & Suburban Railway, and still later into the Washington Railway & Electric Company, serving as superintendent and electrical engineer.

He left this position in 1899 to become connected with the Compressed Air Company as chief engineer, this company having undertaken the development of compressed air motors for the Metropolitan Street Railway, New York City. Later he became more directly connected with the latter road, doing engineering work for Mr. Starrett, who was then chief engineer of this company. In 1900 he went to Pittsburgh as mechanical engineer in charge of shops and power houses

of the Pittsburgh Consolidated Street Railway, now included in the system of the Pittsburgh Railways.

In the latter part of 1901 Mr. Todd was chosen vice-president and general manager of the Cincinnati Traction Company, leaving this position early in 1903 to assume general supervision of the engineering work of the electric railway properties of the United Gas & Improvement Company, Philadelphia, Pa. In the following year he was appointed general manager of the Rhode Island Company, Providence, R. I., serving in this capacity until 1906, when he went to Indianapolis to become vice-president and general manager of the Indianapolis Traction & Terminal Company and the Terre Haute, Indianapolis & Eastern Traction Company.

Upon the death of Hugh J. McGowan in 1911, Mr. Todd was elected president of these two companies, the former now being known as the Indianapolis Street Railway. Mr. Todd served a term as president of the American Electric Railway Transportation & Traffic Association in 1912. He is now the fourth vice-president of the parent Association. He is a member of the American Society of Mechanical Engineers and an associate member of the American Institute of Electrical Engineers.

George J. Smith, who resigned on Feb. 1 as superintendent of equipment of the Kansas City (Mo.) Railways, was recently tendered a dinner by officials of the company at the Hotel Muehlebach, Kansas City. On this occasion Mr. Smith's former associates presented him with a gold watch and chain. Arrangements have been made whereby Mr. Smith, who is now engaged in the automobile business in Kansas City, will act for the company in an advisory capacity.

E. T. Goslin, electrical engineer to the Glasgow Corporation Tramways Department, Glasgow, Scotland, has been appointed general manager of the Clyde Valley Electrical Power Company, to succeed Archibald Page, who has been appointed a technical member of the Commission under the Ministry of Transport for the control of the electrical supply of the kingdom. Mr. Goslin began his career in London with Messrs. Crompton & Company, Ltd., the well known electrical engineers. Thence he went to the Hove Electric Lighting Company, after which he was in the service of the County of London Electric Lighting Company. Mr. Goslin entered the Glasgow Corporation Tramways Department twenty years ago, and during eighteen of these he has been the chief electrical engineer. He is a member of the American Institute of Electrical Engineers. During the war he was lent to the Coal Controller, and was afterwards appointed to the Ministry of National Service as Deputy Director of Labour. Mr. Goslin held the rank of Major in the City of Glasgow Royal Engineers.

L. J. Drake, President

Head of Galena Company at Thirty-Nine —An Authority on Oil and Lubrication

Lauren J. Drake, who has just been elected president of the Galena Signal Oil Company, as mentioned in the last issue of this paper, comes from a family which has been prominent in the oil business, his father, for whom he is named, having been president of the Standard Oil Company of Indiana at the time of his death.

The present Lauren J. Drake is a young man to head such a large organization as the Galena Company, being only thirty-nine on his last birthday. That he should have been selected speaks volumes for the executive ability which he has displayed and the work accomplished during his fifteen years' connection with the company.

His record can be breifly summarized. Born in Keokuk, Iowa, on Aug. 27, 1880, he attended the public schools in Omaha and Chicago, and



L. J. DRAKE

was graduated from the Shattuck Military School in 1899. After six years' service with several important oil companies, where he acquired a general and broad knowledge of the oil business, he joined the Galena Company in 1905 as representative in the Middle West. His election as vice-president and director, with headquarters in New York, occurred in 1916, and as president of the company on Feb. 24 of this year. Mr. Drake is also president of the branches of the Galena Company in France, England and Brazil. The outstanding characteristics which have led to his business success are his resourcefulness, untiring energy and personality.

Mr. Drake is a member of the Railroad Club and Whitehall Club of New York City, the North Hempstead Country Club of Long Island, the Franklin Club of Franklin, Pa., and the Wandango Country Club of Reno, Pa.

H. D. Anderson of Philadelphia, Pa., has been appointed secretary and treasurer of the Wilmington & Philadelphia Traction Company, Wilmington, Del. Mr. Anderson succeeds Charles N. Ryan, resigned.

Charles M. Kemp has been appointed general freight and passenger agent of the Fort Wayne & Northwestern Railway, Kendallville, Ind. Mr. Kemp was formerly station agent at Kendallville.

G. B. Cade, secretary and treasurer of the Atlantic Coast Electric Railway, Asbury Park, N. J., has been appointed assistant to S. F. Hazelrigg, president of the company. Mr. Cade has been connected with the road for more than twenty years.

Obituary

J. R. Harrigan Dead

J. R. Harrigan, vice-president and general manager of the Kansas City, Clay County & St. Joseph Railway, Kansas City, Mo., died on March 16 at his home in Kansas City after an illness of ten days. Mr. Harrigan, who took an active interest in the life of Kansas City, was also president of the Kansas City Interurban Freight Terminal Company.

Mr. Harrigan entered street railway work in 1886 following his graduation from the high school at Eau Claire, Wis. For two years he served as manager of the Eau Claire Street Railroad, operating a horse-car line. He then went into other business, but returned to Eau Claire in 1897 to assist in the electrification of the street railroad property and to act for four years as general manager of the new line, the Chippewa Valley Electric Railway. In 1901 he was appointed general superintendent of the Dayton, Springfield & Urbana Railway, Springfield, Ohio. In the following year he became general manager of the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, Newark & Zanesville Railway, in which capacity he continued until the purchase of the roads by the so-called Widener-Elkins syndicate several years later, when he resigned.

In 1906 Mr. Harrigan assumed the management of the Canton-Akron Railroad, of which he was in charge until its absorption by the Northern Ohio Traction & Light Company, when he went to Buffalo, N. Y., as assistant general manager of the Buffalo & Lake Erie Traction Company. In 1908 he was appointed general manager of the Columbus, Delaware & Marion Railway, Columbus, Ohio. He resigned this position in 1910 to become vice-president and general manager of the Des Moines (Iowa) City Railway. In July, 1912, he resigned to assume the duties of general manager of the Kansas City, Clay County & St. Joseph Railway. He became vice-president of the company five years later, continuing to serve as general manager.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Wood-Pole Market Improving

White Cedar Poles Advance 10 Per Cent —Increase in Chestnut Pole Prices Expected

Wood-pole sales are improving. Business is encouraging and as soon as the railroads recover from the effects of the storm conditions over the country, deliveries will be much better than for some months past.

Although cutting operations have been difficult during the present season, the work is pretty well along, and were it possible to get transportation at the present time, the distributing yards of the different pole companies would be full to overflowing. As it is the poles have been cut and are on the ground waiting to be shipped. Car shortage is the greatest menace, although in some instances pole interests have built their own flat cars for moving poles to the main line of the railroads. Some stocks already have been received, and a large amount of poles are now loaded or en route.

Prices on red cedar poles have not advanced since the first of the year, when a general increase was made averaging from 10 to 15 per cent. White cedar, however, has advanced 10 per cent during the past week. There is a large demand in the East and South for both Northern and Western red cedar and also for Northern white cedar. In the West the greatest demand is for Western red cedar, which is cut in the off season and is in reality a local product obtainable on short notice at almost any time of the year.

Chestnut poles have not advanced since last year, but an increase is now looked for and may be announced at any time. Some of the best grades grown in parts of Virginia and Pennsylvania have been destroyed by blight although there is a considerable supply south of these distircts which will be available.

Grounding Device Sales Picking Up

Sales of grounding devices for a year past have been rather spotty among various manufacturers. Where labor conditions have permitted operators to work their plants at full capacity an increase in business has been shown for the year. Where labor conditions hindered production, inquiries received by the manufacturers indicate that the business of the year just closing would otherwise have been above that of the year previous. Ability to furnish the grounds has been a big factor in the sale, in addition to more settled conditions and more liberal buying in this country and, particularly, the demand that has been growing abroad.

Current sales show an increase. Since the time to manufacture these devices is small, shipments can be made promptly, or up to three weeks. In some cases, however, labor conditions are drawing out this time considerably.

Railways now coming into the market can get deliveries in ample time to do their spring work and at prices that are in all probability much better than those which will obtain at a later period.

Heavy Sales Recorded for Track Maintenance and Reconstruction

Girder and T-Rail, Special Work, Track Accessories, Steel Ties and Other Substitutes for Wooden Ties Have Prosperous First Quarter

Sales of rail, ties and other materials for track maintenance and reconstruction work for the past three months have been better than for any corresponding period during the past three years. As the representative of a large special-work manufacturer expressed it, the volume of business has shown a considerable improvement over pre-war sales. Sales of one of the largest manufacturers of special track work for the month of February in one central district were larger than sales for the whole year of 1919. In the New England district, railways bought heavily of all kinds of track equipment and supplies. Much high T-rail was contracted for although the volume of orders for girder rail was considerably greater.

Buying Is General

Standard sections are requiring much mill space and manufacturers agree that the buying on the part of the railways has been very satisfactory. It is known, however, that the railways are in need of large quantities of track supplies and are confident that an enormous volume of business will be placed during the year although it is believed that the buying during the second quarter will not be as large in volume or as well distributed as during the first quarter.

No further increases in rail prices are announced with the exception of a slight advance in prices on complicated layouts of special work.

Mills are in shape to accept further orders on both standard and on special sections although deliveries are subject to certain conditions. Double track crossings and similar pieces can be obtained in four to five weeks. For standard sections, conditions depend largely on the quantity ordered and arrangements necessary at the mill to commence the rolling. Orders are pooled with the result that a number of railway companies have their requirements for new rails supplied from a single rolling.

Track spikes, bolts and nuts, splice bars and miscellaneous equipment have been very active for the past two months. Owing to heavy purchasing by the steam road, deliveries have lengthened considerably, sixty to ninety days now being quoted.

Demands for steel ties and other substitutes for wooden ties have been particularly active, in fact, it is believed that the principal factor now is to obtain raw material enough to cope with the steady demand for this class of goods.

Insurance for Employees

Commencing March 1, an insurance policy for the sum of $500 will be given without cost to every employee of the Westinghouse Electric & Manufacturing Company who has been in the service of the company for a period of six months or more. In addition, the employees, after April 1, may increase the value of their policies to amounts varying from $1,000 to $2,000, depending upon their length of service and continuity of savings. All employees who have been in the company's service for six months or longer and who deposit a sum each pay day in the employees' savings fund equal to 2 per cent or more of their earnings will not only receive 4½ per cent interest compounded semi-annually on such deposits but in addition will automatically have their insurance increased to amounts up to $2,000, depending on the length of time they have been with the company.

After an employee has maintained the required deposits for a period of five years he may discontinue or withdraw his deposits from the savings fund without in any way affecting the value of his insurance policy.

Lightning Arrester Deliveries Good

Heavy Demands for Oxide Film Type and Increased Production Enable Manufacturer To Decrease Price

Manufacturers are better able to deliver lightning arresters than almost any other kind of equipment. Although sales have been fairly heavy, greatly increased production has enabled manufacturers to get some stock ahead. This, however, it is expected, will be swallowed up by the first rush of orders. As the heavy buying of the year takes place during the spring months, production of arresters is being pushed to the limit in an attempt to keep ahead of orders placed.

Distribution lightning arresters, both of the compression-chamber, multi-gap type and of the aluminum-cell type for 2,300-volt service, are in fair demand. Ample stocks of each kind are held ready for shipment. In the larger sizes of compression-chamber, multi-gap arresters, deliveries are four, eight and ten weeks respectively on voltages of 5,000, 7,500 and 15,000. Arresters of special design require four to six weeks additional.

In the high-voltage transmission field, deliveries on both aluminum-cell and oxide-film arresters range from two to eight weeks, depending upon size and type.

Direct-current, aluminum-cell arresters, such as are mounted on electric cars, can be delivered in quantity from stock on certain sizes, while for the remainder, two to three weeks is required. Magnetic blowout arresters for cars can be delivered in fairly large quantities from stock. The maximum delivery, however, being four weeks.

Prices have not changed since last fall with the exception of a small increase on compression-type arresters. The oxide-film arresters, however, have been decreased in price, on an average 5 per cent. According to the manufacturer, the decrease was made because of greater production and increased sales.

Nineteen Cars Destroyed by Fire

Nineteen cars were consumed in a fire that destroyed one of the buildings of the Danbury & Bethel Street Railway, Danbury, Conn., on March 16, causing a loss estimated at between $50,000 and $60,000.

The fire destroyed all but one of the company's summer cars. Orders will be placed immediately for new rolling stock.

The fire department succeeded in saving the other buildings of the railway and thus prevented the complete crippling of the road by the destruction of its entire rolling stock. The closed cars in use at present were in one of the neighboring buildings and escaped damage.

The eleven single-truck open cars destroyed were purchased many years ago, but were still in excellent condition. Their loss will be felt severely, especially if difficulty is experienced in procuring new rolling stock before warm weather arrives.

Transformer Prices Advanced 10 Per Cent

One of the largest manufacturers has advanced prices on all transformers approximately 10 per cent, on account of increased costs of raw material. Deliveries for distribution type range from delivery out of stock up to four weeks. High-tension transformer deliveries are quoted from ten to twenty weeks, depending on size. Two of the largest manufacturing companies report a good supply of standard stock sizes coming through the factories which will be available for delivery as soon as rail shipments improve.

Factory conditions are good as far as labor is concerned but delays in getting raw material has held up important work.

General Electric Leases War Plant

Announcement has just been made that the General Electric Company has leased, with option to purchase, the forty-acre war plant of the Remington Arms Company at Bridgeport, Conn. This transaction provides the company with 1,500,000 square feet of floor space, available almost immediately, for the production of light rather than heavy apparatus. The plant consists of thirteen identical unit buildings easily accessible and conveniently interconnected. According to the present condition of business, the company could utilize this space for virtually any kind of apparatus, the need for space is so great. It is expected that between four and five thousand employees will be required to man the plant.

Pole-Line Material Prices Materially Higher

An increasing demand is felt for pole-line material with the approach of the spring construction season. Generally speaking, stocks are in fair shape—much better, in fact, than stocks on other electrical materials.

Prices have advanced on almost all line material except wire. White cedar poles are up 10 per cent, cross-arms 8 per cent, insulators 10 per cent, hardware 10 per cent, and locust pins 25 per cent.

Cross-arms appear to be short east of the Rockies. It is reported that the Pacific Coast yards are piled high with cross-arms, but owing to a local shortage of rolling stock it takes from three to six weeks to make a shipment.

St. Louis Car Sells Direct

Effective March 20, the St. Louis Car Company will sell safety cars direct to the railways. Edwin B. Meissner, vice-president who is authority for this statement says that the company has now established its own safety car sales organization and that its engineers and entire sales force will be at the disposal of railway executives to assist in solving traffic problems.

Necessary changes in shop facilities have been made and arrangments completed at the St. Louis works for a greatly increased production of standard safety cars. At the present time, the schedule calls for a production of five standard safety cars per working day, but the company is prepared to increase its output if the occasion demands. Previous to this time, safety cars manufactured by the company have been sold entirely through agents.

Rolling Stock

Boston (Mass.) Elevated Railway is in the market for seventy-five center-entrance motor cars in addition to the 100 cars recently purchased.

Lake Shore Electric Company, Sandusky, Ohio, has purchased sixteen safety cars for use on the Sandusky city lines, from the National Safety Car & Equipment Company.

New Orleans Railway & Light Company, New Orleans, La., has placed an order for forty safety cars with the National Safety Car & Equipment Company.

Interstate Public Service Company, Indianapolis, Ind., is reported to be in the market for two combination dining and parlor cars for use in connection with its limited trains running between Indianapolis and Louisville.

Terre Haute Traction & Light Company, Terre Haute, Ind., placed an order on March 4 with the American Car Company, St. Louis, Mo., for ten additional safety cars. This will bring the total number of safety cars purchased by the Terre Haute company up to sixty-six, all of which are of absolutely identical design and construction.

United Railways & Electric Company, Baltimore, Md., noted in the Feb. 21 issue of the ELECTRIC RAILWAY JOURNAL as placing an order with the J. G. Brill Company for thirty-three safety cars and for 100 center-entrance trailers, has specified the following details for this equipment.

Number	33
Date of order	Feb. 12, 1920
Date of delivery	April 15, 1920
Type	Safety
Seating capacity	32
Weight, total	Approx., 16,000 lb.
Length over all	28 ft. 0¾ in.
Truck wheelbase	8 ft. 0 in.
Width over all	7 ft. 10⅝ in.
Rail to trolley base	10 ft. 8 in.
Body	All steel
Interior trim	Cherry
Roof	Arch
Air brakes	Safety Car Devices Co.
Armature bearings	Sleeve
Car signal system	Faraday
Car trimmings	Bronze
Control	West. & G. E.
Fixtures	Curtain Supply & National Lock Washer
Curtain material	Pantasote
Designation signs	Hunter signs
Door mechanism	National Pneumatic
Fare boxes	Johnson DM-2
Wheelguards	HB
Gears and pinions	Standard

Hand brakes	Ackley Adjustable
Heaters	Consolidated
Headlights	Dayton No. 1583 A
Lightning arresters	G. E. M. aluminum cell
Motors	West. 508 and G. E. 264 inside hung
Varnish or enamel	Enamel
Registers	International Single Ry.
Sanders	Ohio Brass
Sash fixtures	Brill
Seats	Brill
Seating material	Slat cherry seats
Slack adjuster	Gould
Springs	Brill
Step treads	Universal
Trolley catchers	Q. P.
Trolley base	U. S. No. 6
Trolley wheels	Kalamazoo Stock 5-in. wheel
Trucks	Brill
Ventilators	Brill
Wheels	26-in. Rolled Steel

Specifications for the trailers are given below:

Number	100
Date of order	Feb. 13, 1920
Date of delivery	Sept. 1, 1920
Type	Double end centre entrance trailer
Seating capacity	62
Weight, total	25,000 lb.
Bolster centers, length	24 ft. 0 in.
Length over all	43 ft. 2½ in.
Truck wheelbase	5 ft. 0 in.
Width over all	8 ft. 4½ in.
Height	10 ft. 11½ in.
Interior trim	Cherry
Roof	Monitor
Air brakes	Westinghouse trailer
Bumpers	Angle iron with Anti climbers
Car signal system	Faraday
Car trimmings	Bronze
Center and side bearings	Brill
Couplers	Ohio Brass Tomlinson No. 8
Curtain fixtures	Curtain Supply No. 88
Curtain material	Pantasote
Designation signs	Hunter
Door mechanism	Manual pneumatic National Pneumatic
Fare boxes	Johnson DM-2
Hand brakes	Ackley Adjustable
Heater equipment	Consolidated
Paint, varnish or enamel	R. F. Johnson Co.
Registers	International Single R-7
Sash fixtures	Brill
Seats	Brill
Seating material	Cherry Slab
Slack adjuster	Gould
Springs	Brill
Step treads	Universal
Trucks	Archbar
Ventilators	Brill Ventilator openings
Wheels	26-in. Rolled Steel

Trade Notes

The Johnson Fare Box Company, Chicago, has received an order from the United Railway & Electric Company, Baltimore, Md., for 133 registering fare boxes, and from the Memphis Street Railway for 100 additional boxes.

Wagner Electric Manufacturing Company, St. Louis, Mo., has removed its Buffalo office to 16 Carlton street. Alfred W. Baldwin, who has been connected with the company for a number of years, is in charge as branch manager.

Wheeler Condenser & Engineering Company, Carteret, N. J., has recently designed a vertically split casing of the tail pump for vertical jet and rectangular type counter-current condensers. The feature permits quick removal or inspection of the pump rotor or other internal part.

George Cutter Company, South Bend, Ind., announces the acquisition by the Westinghouse Electric & Manufacturing Company of a financial interest in that company. The management and the commercial policies will remain unchanged, but advantage will be taken of the Westinghouse engineering and other facilities to expand the Cutter Company's activities and develop its lines to enable it to more effectively serve its customers and the industry. The Westinghouse Company will operate as sole distributors for the Cutter Company's products.

Ohio Brass Company, Mansfield, Ohio, has accepted the resignation of A. L. Wilkinson as vice president of the company. Mr. Wilkinson came with the company in 1894 and during the twenty-five years since that date served as salesman, general sales manager, secretary and vice president, having been elected to the latter office in February, 1919. The resignation was accepted by the directors only after Mr. Wilkinson had urged them to release him. For some time he has felt the need of a complete rest for the benefit of his health and he desired freedom from all responsibility.

Franchises

Los Angeles (Cal.) Railway: The Los Angeles has received a franchise from the Los Angeles City Council for extension of a line from Pico Street to Tenth Street.

Los Angeles (Cal.) Railway.—The City Council of Los Angeles has passed a franchise ordinance authorizing the Los Angeles Railway to install an electric line in Broadway between Tenth and Pico Streets, Los Angeles.

Santa Fe, N. Mex.—L. Britt, representing eastern capitalists, has applied to the Santa Fe City Council for a franchise to lay car tracks and build a power-plant in the city. If the franchise is issued work will be begun within the next few months.

Power Houses, Shops and Buildings

Pennsylvania - Ohio Electric Company, Youngstown, Ohio.—The Pennsylvania-Ohio Electric Company, formerly the Mahoning & Shenango Railway & Light Company, will shortly begin the construction of a new power plant in which the initial installation will include two 30,000-kw. turbo-generator units. This plant will probably be laid out for an ultimate capacity of 100,000 kw., which it is estimated will be needed to care for the company's business within ten years.

Track and Roadway

Boston (Mass.) Elevated Railway.—The Boston Elevated Railway will equip its Washington Street tunnel line with a system of three-position colored light signals and automatic stops. Altogether, 1.14 miles of double track, comprising thirty-three blocks, will be equipped. The system will be run by operating current, with the exception of the automatic stops, which will be of the pneumatic type.

Portland Railway, Light & Power Company, Portland, Ore.—The Oregon Public Service Commission has refused the application of the city of Portland for the extension of a line of the Portland Railway, Light & Power Company from the city of St. Johns to the St. Johns terminal. The city's application was based upon an agreement with the company made in October, 1919.

Dallas (Tex.) Railway.—The Dallas Railway has been ordered by the Dallas City Commission to rebuild its tracks on South Lamar Street from Wood to Alexander Street.

Texas Electric Railway, Dallas, Tex.—This company has opened a passenger and freight station at McKinney, Tex.

Seattle (Wash.) Municipal Street Railway.—Mayor Fitzgerald of Seattle has refused to approve an ordinance authorizing an extension of the Ravenna Street line of the Seattle Municipal Street Railway, because the terms of the ordinance do not conform to the provisions of the bond ordinance appropriating funds for the extension.

Pacific Electric Railway, Los Angeles, Cal.—This company will lay new tracks on East Colorado Street, Pasadena. Work will begin on April 1.

Public Service Railway, Newark, N. J.—The State Board of Public Utility Commissioners has directed the Public Service Railway to improve the condition of the tracks and roadway in Main Street, Moorestown, and to resume service of a safe, adequate and proper nature by June 30.

New Advertising Literature

Sangamo Electric Company, Springfield, Ill.: Bulletin 45. Description of the various types of ampere-hour meters made by this company.

Electric Service Supplies Company, Philadelphia, Pa. A pamphlet on genuine Shelby seamless cold-drawn steel trolley poles.

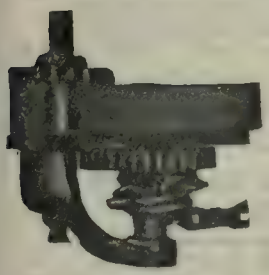
Link-Belt Company, Chicago, Ill. A pamphlet on the Pratt ballast cleaner which screens all dirt out of stone ballast between tracks, giving effective drainage that reduces rotting of ties.

Templeton, Kenly & Company, Ltd., Chicago, Ill. Bulletin 9020, "Track Maintenance. A Problem and Its Solution" presenting recommendations for railway maintenance with demonstrated economies. Details of construction of No. 101 simplex track jacks with considerable data also are given.

General Electric Company, Schenectady, N. Y. Bulletin 44470 on its GE-264 light-weight railway motor the hourly rating of which is 25 hp. on 600 volts with input of 37 amp. Details of construction are given and illustrations shown of armature, pressed steel gear case, brush holders, exciting and commutating field coils in addition to data concerning weights, trucks, etc. Characteristic curves for different conditions of operation also are included.

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10. **The mileage of the road.**
11. **The number and kinds of cars.**
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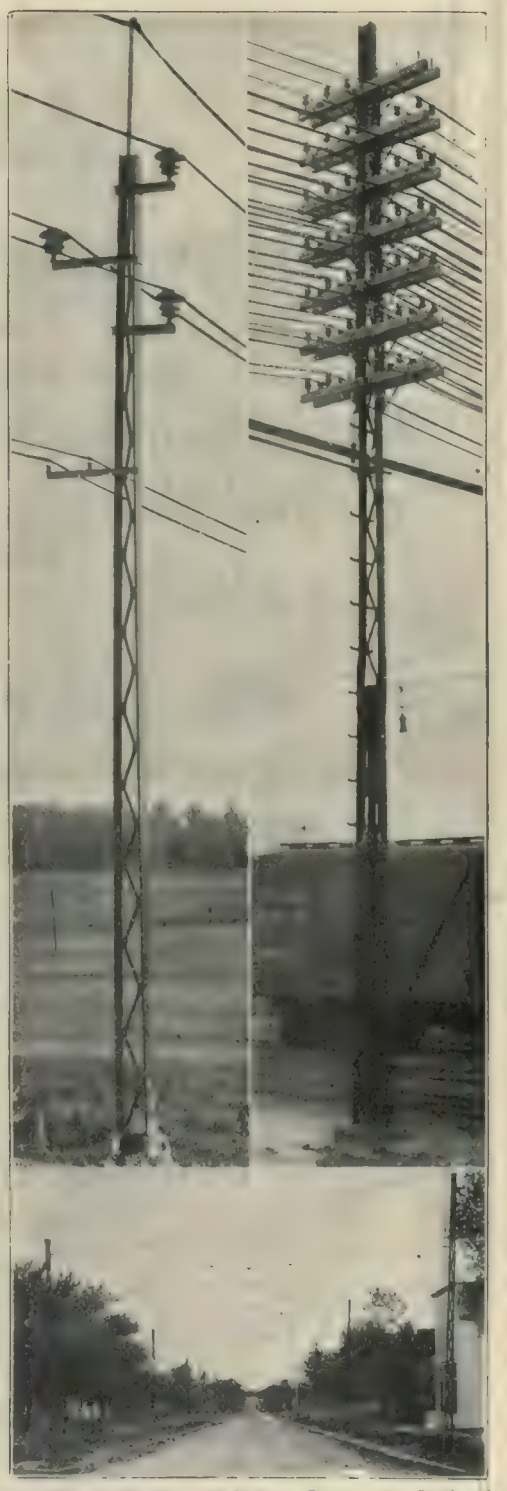
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Bates Expanded Steel Truss Co.
Chicago, Ill., U. S. A.



Des Moines City Ry., Des Moines, Iowa—over 2100 poles in use in Des Moines.

Bates One-Piece Steel Poles

Announcement

Our Wire Mill completed, we now cast, roll and draw Aristos COPPERWELD Copper Clad Steel Wire under one roof and under our own supervision.

Every Coil is Inspected and Guaranteed

Aristos COPPERWELD is especially designed and adapted for Railway Signal Work and many other railroad uses. We carry a stock of bare, weatherproof, strand, twisted pair, bond wires, tie wires, ground rods and nails in our Mill and Chicago Warehouse.

Made and sold exclusively by

COPPER CLAD STEEL COMPANY

Mill and Main Office, RANKIN, PENNA.,

New York Sales Office:
Room 530—30 CHURCH STREET

Western Sales Representative:
STEEL SALES CORPORATION, CHICAGO, ILLINOIS

Export Sales Office:
Room 530—30 CHURCH STREET, NEW YORK

Safety Cars DIRECT to the trade

The Quality Shops are now selling Safety Cars direct to the trade having established a Safety Car Sales Organization for that purpose.

Send us your inquiries when in the market. Let our Safety Car Engineers help you solve your traffic problems.

St. Louis Car Company

St. Louis, Mo.



Lincoln used to tell the story of

the man who refused to mend a hole in the roof of his house. When it rained he couldn't and when the sun shone he didn't need to. And he wondered why people called him a failure.

A big company we know refused to advertise when business was bad—and when business picked up said there was no need to advertise.

Some day that company will be wondering why they failed to keep pace with their competitors.

The point is—

Keep Advertising in the

SEARCHLIGHT SECTION



NACHOD SIGNALS—A big factor
in the success of the Safety Car at Ft. Wayne

Fort Wayne, Indiana, was one of the pioneer cities in equipping its lines with the Safety Car. At the present time they have eighty-five cars operating on the "Safety" principle.

From Actual Experience

Sam W. Greenland, General Manager, Fort Wayne and Northern Indiana Traction Co., of Fort Wayne, Ind., specifies in the *Electric Railway Journal* above rules for remunerative operation of the Safety Car.

Fort Wayne is following these rules. In carrying out the fifth rule they have equipped their lines with the best automatic signals which naturally are Nachod.

Nachod Spells Safety

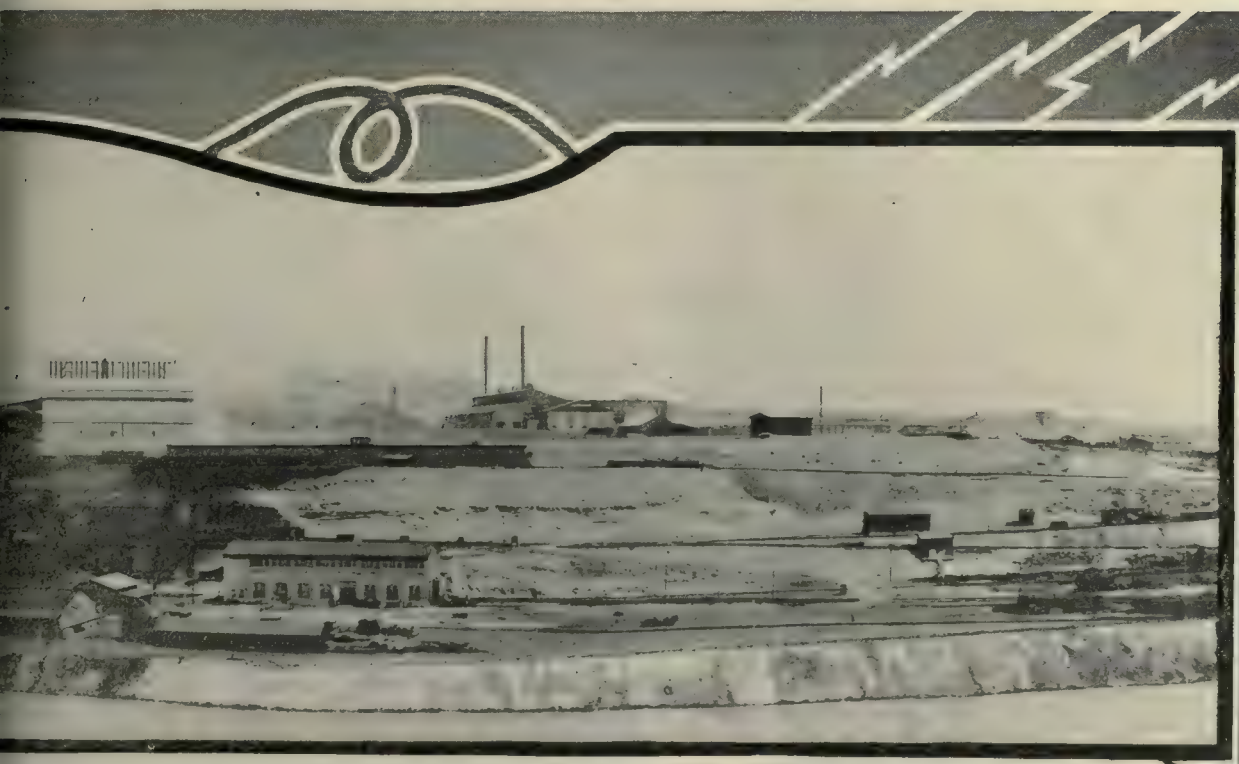
They are simple, containing only three parts: the signal aspect consisting of lights and color disks combined for night and day indication; the intermediate mechanism or relay, which converts the transient current impulses caused by the passage of the car under the contactor into the signal indications; the controlling device or the trolley contactor in the overhead. Nothing to get out of order. They are positive and secure.

Safeguard your Safety Cars with Nachod Signals

NACHOD SIGNAL CO., Inc.

Louisville, Kentucky


Write
for
Catalog
General
Office
Rolling Mill
Dept.
CHICAGO



—the Plant that's back of ANACONDA COPPER WIRE

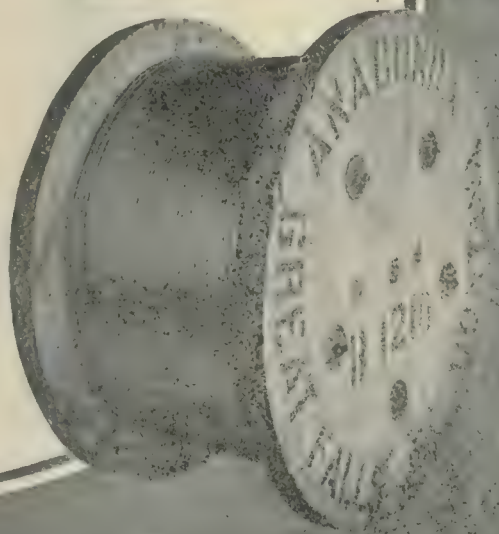
DOWN from the mountains come great freight trains carrying thousands of tons of ore from the Anaconda copper mines. Daily, these immense shipments of ore are delivered to the company's smelters to be refined and cast, ready for conversion by the rolling mills into wire and strand for the markets of the world.

Every step of the manufacture of Anaconda wire, from the time the ore is taken from the mine until the finished product leaves the shipping rooms, is carried out in the immense Anaconda plant under Anaconda supervision.

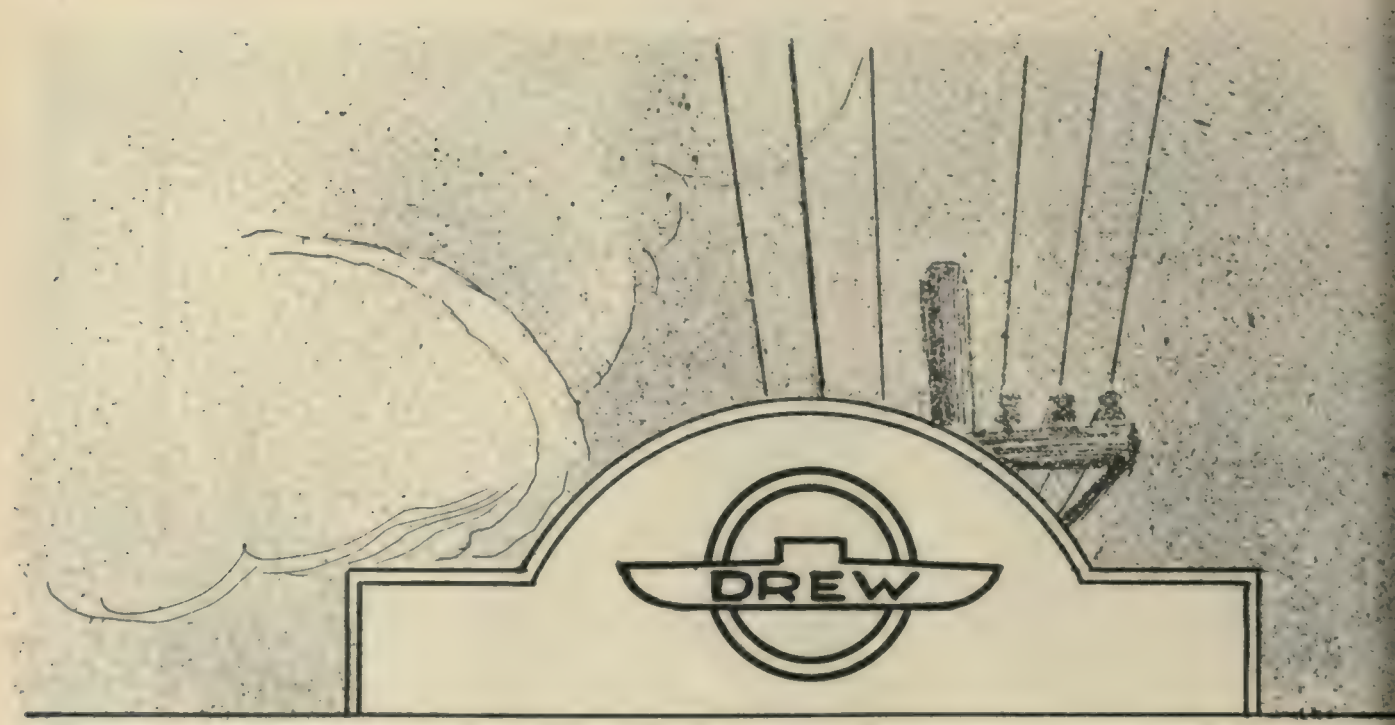
The rolling of the copper into rods, the drawing of the rods into wire, the annealing, the stranding, the reeling—all are done according to rigid, self imposed specifications.

Think what this great plant means to users of copper wire. It means, first, a product of the highest quality; supervision during manufacture insures that. It means reduced costs because manufacture at the source of the raw material supply eliminates expensive freight shipments to and from the rolling mills in the east. And, finally, it means the prompt delivery of all orders. Large daily capacity and immense stocks of standard sizes eliminate the possibility of delay in shipment.

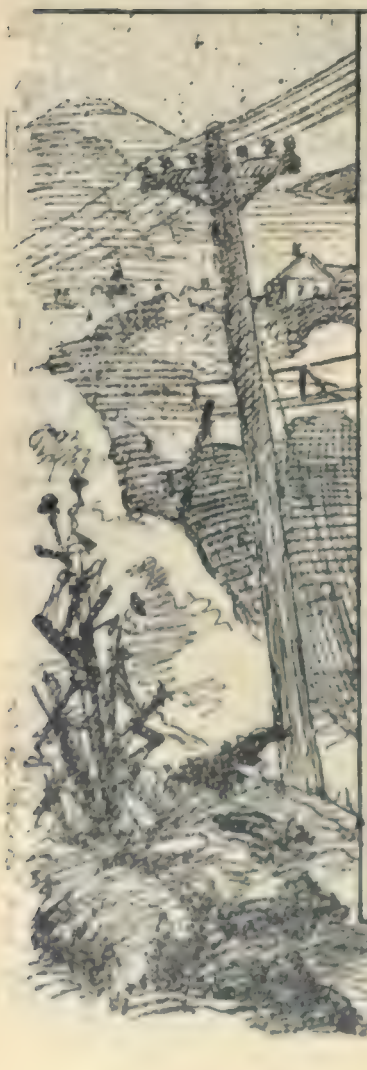
Whatever your requirements may be, the Anaconda Mills are prepared to supply them. Whenever you think of copper wire and cable think of "Anaconda."

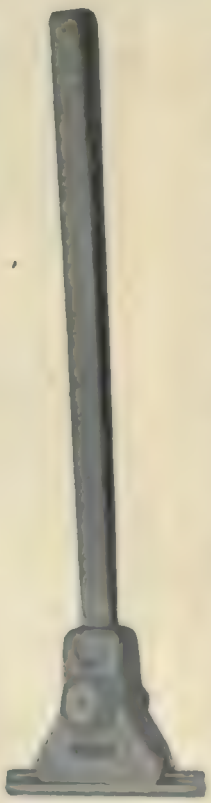


ANACONDA COPPER MINING CO.
Rolling Mills Great Falls, Mont.



Overhead Line Material and





The DREW Catenary Trolley Hanger

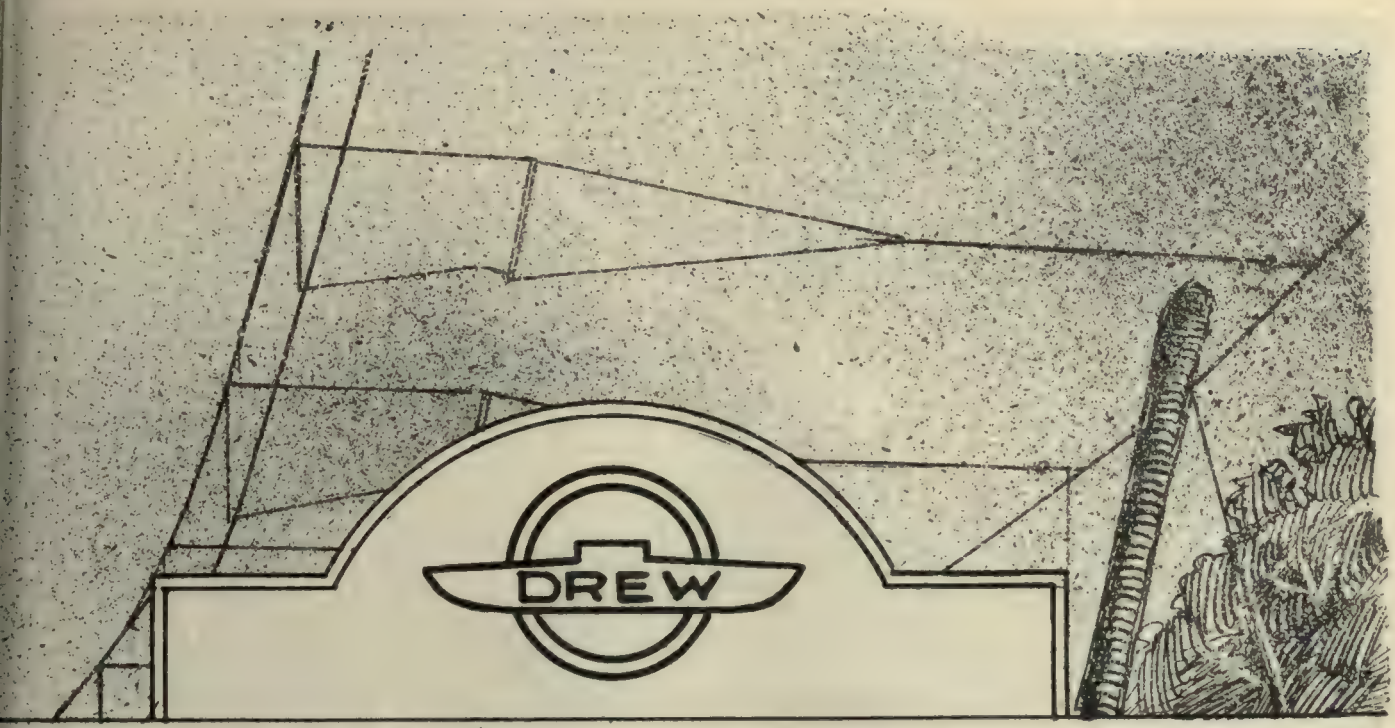
The Drew Trolley Hanger is a single unit assembly, from stock room to installation. By slightly loosening the ½-in. bolt, the jaws spread apart, releasing one end of the strap which is then slipped over the messenger wire. The jaws are then re-clamped on to the trolley. There is at no time any loose or separable parts to be lost or dropped off the tower.

The strap is unusually resilient owing to the flat cross-section with rounded corners. It has more contact with the messenger—consequently less wear. When in a free position the ends of the loop are spread apart sufficiently to pass over the messenger, therefore not requiring any manual pressure. The ends of the strap are locked *inside* of the Clamping Ear. They cannot become loose or get away. As long as the ½-in. carriage bolt remains tight enough to hold the trolley wire, the bolt will stay in place. The bolt is located far enough away from the trolley to make this type of hanger suitable for both pantagraph and trolley wheel operation.

The Drew Trolley Hanger is but one unit of our full new line of catenary equipment now ready for distribution. Write today for comprehensive blueprint catalog and samples.

The Drew Electric and Mfg. Co.
Cleveland, Ohio



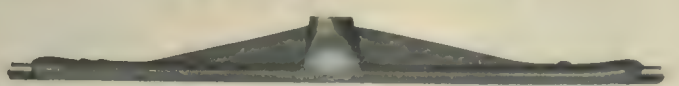


Electric Railway Specialties



Drew Samson Splicer

These splicers are cast of a special bronze and are non-arcing. They have repeatedly outworn the wire in which they were installed under the most severe operating conditions.



Drew Clinch Ears

Made of bronze—cast in one piece with a deep, accurately gauged groove. The concave sides of the boss give a smooth wheel movement on either straight line or curve.



Drew Frog

This frog is especially designed for interurban and high speed roads. It can be furnished in either bronze or malleable iron and is guaranteed to withstand the strain and stresses of the most severe service.

Lightning & the Insulator



Up New England Way

A FEW years ago a prominent operating company in New England had occasion to select insulators for its 38,200 volt lines. The choice was not hastily made since the favored design must perform an exceptional function. The insulators were to be installed on lines running through a territory noted for the severity and prevalence of electrical storms.

The first baptism of lightning came on July 4, 1918. A terrific storm held away throughout the entire valley. Telephone and telegraph lines and trees were mowed down, houses and barns were damaged; bolts of lightning played 'round about as bullets on the battlefield. The power lines did not escape. Cross-arms were torn loose and the poles splintered; braces were mangled; ties charred and foot-bolts literally disappeared, but the "service" was not affected. The insulators had stood the test, not one having been lost nor even damaged.

On Oct. 17, 1919, another typical New England storm assailed a neighboring line of the same system. Like insulators were used on this branch also. For four hours on that day everything within a five-mile radius was in constant danger. The property loss was appalling, the destruction even greater than before. In some cases lightning had actually shattered the poles, cutting them off at the base, and in others cross-arms were torn loose and the pole tops splintered into bits. But again the result was the same. Service had been uninterrupted for the insulators had come through unscathed.

And that is only one of the many reports which indicate the absolute dependability of Pin Type Insulator No. 3058, one of the

"Thomas Quality" line.

Write for further details of this remarkably sturdy design.

THE R. THOMAS & SONS CO.

East Liverpool, Ohio, U. S. A.

New York Boston Chicago London

DOSSERT CONNECTORS

Save Cost of Disconnecting Knife Switches

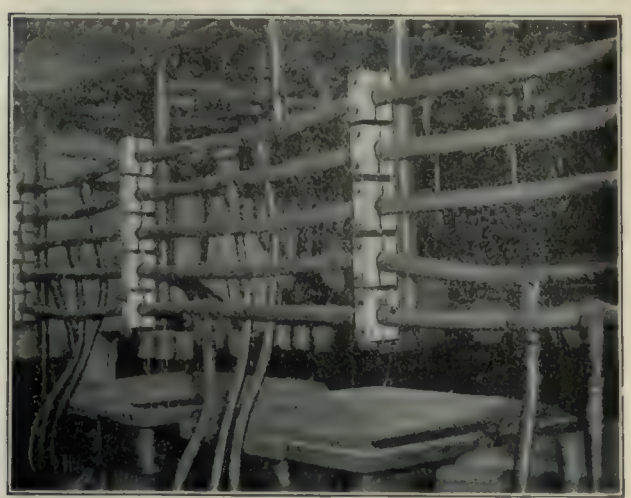
WEATHERPROOF CABLES USED FOR LOW-TENSION BUSES

Leads Joined to Them by Connectors Which Permit Changing Circuits without Use of Disconnecting Switches

By the use of weatherproof cables and Dossert connectors installed in the manner pictured one company has been able to reduce considerably the cost of its low-tension buses. Disconnecting knife switches are not needed as a transformer can be cleared from its low tension bus or connected to another with little effort in case of accident. The low-tension buses, which are five in number, are hung directly over the transformers by means of pipes attached to the ceiling and by porcelain clamps. Only a small amount of copper is needed for the leads from the buses to the transformers.



Dossert Cable Tap



LOW-TENSION BUSES ARE FLEXIBLE AND ARE HUNG DIRECTLY OVER TRANSFORMERS

DOSSERT & COMPANY

H. B. LOGAN, President

242 West 41st Street, New York

IT'S SAFE!



The NEVER-CREEP
IS THE BEST
STORM INSURANCE

NEVER CREEP

ASK YOUR JOBBER

Chance Company
Dept. E.R.J. Centralia
Mo. U.S.A



In one of these four men, perhaps, you will find a man whose position and income were much the same as yours

What happens to the incomes of men?

FOUR average business men, typical of thousands of others who enrol for the Modern Business Course and Service of the Alexander Hamilton Institute—what happens to the incomes and the business positions of such men when they add an all-round business training to their practical business experience?

The answer to that question need not be left to guess-work. The Institute has the record of the progress of these four men—and several hundred like them—in their own handwriting.

These are the facts

AN assistant cashier was earning $3,000 a year at the time of his enrolment with the Institute; today he is Vice-President and his salary is $7,200.

A purchasing agent was earning $4,000; today he is General Manager, and his salary is $12,000.

A Western Manager's income when he enrolled was $4,160 a year; and this year, as Sales Manager, he will earn $20,000.

A chief clerk was earning $2,500 when he decided to shorten his road to success by the Institute's help; today he is a department head in an important bank, and his income is $7,000.

The combined earning power of these men has increased more than 300%; and every one of them states in his own handwriting that the Alexander Hamilton Institute has been one of the most important, if not the most important, factors in his success.

"Would you advise other ambitious men to enrol?"

WE asked each one of them to answer that question in complete frankness.

"By all means," the Vice-President answered, "because the knowledge one obtains is practical and not theoretical. Especially does this apply to men who have not had long years of schooling in youth."

"Would advise to enrol at once," the General Manager answered, "It is a real help in understanding and solving everyday problems."

"Yes," said the Department Head, "because, other things being equal, advancement depends upon a broad knowledge of business facts and a firm grasp of business principles."

"Yes," said the Sales Manager, "because I feel that the time I invested in the Course was the best investment I ever made."

10,000 *are technical men*

NEARLY 10% of the men enrolled for the Institute Course and Service are technical men who sought to advance themselves by learning the fundamentals of industry.

They are scattered thru every field of industry. In the Standard Oil Company are 801 men; in the United States Steel Corporation, 545; in the National Cash Register Co., 196; in the Winchester Repeating Arms Co., 167; in the General Electric Co., 402; and so on down the list of the biggest concerns in America.

The kind of men enrolled

MEN who have reached the heights of executive responsibilities in technical industries are among those enrolled for the Institute Course and Service.

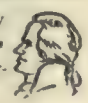
Such men as Hi F. Harris, President and General Manager of the Bethlehem Motors Corporation; Stephen B. Mambert, Vice-President Thomas A. Edison Industries; I. C. L. Fish, Professor of Railway Engineering, Stanford University; John G. Wood, President Midwest Engine Company; T. H. Bailey Whipple, Publicity Department Westinghouse Electric & Manufacturing Company, and scores of others gladly testify as to the value of the Institute and Service.

"Forging Ahead in Business"

FOR your convenience all the facts you want are published in a 116-page book issued by the Institute entitled "Forging Ahead in Business." It tells just what the Modern Business Course and Service is, how it works and exactly what it has done for men whose problems were like your own.

Fill in the coupon, mail it, and your copy of "Forging Ahead in Business" will come at once.

Alexander Hamilton Institute
484 Astor Place, New York City



Send me without obligation, "Forging Ahead in Business."

Name. .....
Print here

.....

Business Address. .....

Business Position. .....



What are we going to do about the electric railways?

THERE'S one habit that is common to all McGraw-Hill publications—and the men who make them go. They make it their business to know the needs of their respective industries, and having learned those needs, they get out and hustle to satisfy them.

Electric Railway Journal, for example, has consistently championed the just demands of the field it serves. It has upheld the electric railway as an indispensable factor in our transportation system. It has foreseen the shrinking of the five-cent piece and advocated every fare increase which has been shown to be square.

Its leadership in electric railway thought, which is frankly acknowledged, has been maintained regardless of cost.

Standing squarely for all that is permanently constructive in its industry, the *Electric Railway Journal* has earned the approval of its field, which is indicated by the fact that it is read by the executives who control 98 *per cent* of all cars and 99 *per cent* of all existing mileage in this country—by actual count.

The electric railways must go forward. Their development is a part of the development of the nation. In order to progress the electric railways must have sympathy and support—and the sort of sympathetic support they need most will come from representative engineers.

We urge each of the 168,000 engineers who have a common bond in the eleven McGraw-Hill publications to consider the *real* interests of the railways in his neighborhood, and to bring his influence to bear on the proper solution of their problems.

H-3

The 11 McGraw-Hill Publications

Power
Coal Age
American Machinist
Electrical World
Electrical Merchandising
Journal of Electricity
Electric Railway Journal
Engineering News-Record
Ingeniería Internacional
Chemical & Metallurgical Engineering
Engineering & Mining Journal

McGraw-Hill Co., Inc.
Tenth Avenue at 36th Street
New York

The advertisement on the opposite page

is appearing in the current issues of the eleven McGraw-Hill publications, which have a total circulation of 168,000 engineers and industrial executives.

Figure for yourself the effect of 168,000 influential men urging justice for the electric railways.

Electric Railway Journal.

Save your rails by reducing corrugation!

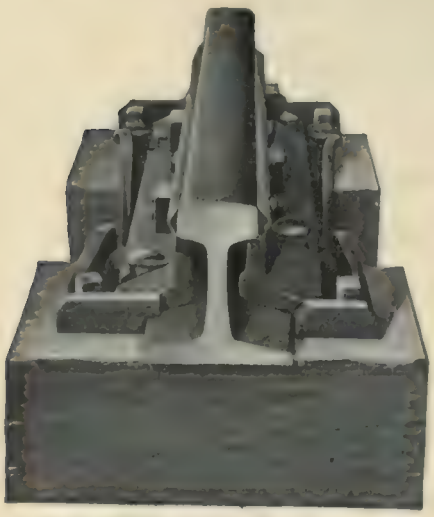
ABBOTT RAIL-JOINT PLATES

afford a much needed protection

You have heard the expression—"The life of the joint is the life of the rail," and you know that nowadays you must make that life long.

The cost of rails today in comparison with preceding years is well brought out in J. A. Emery's data before the Federal Electric Railways Commission. Between 1902 and 1915, the base price of girder rail, per gross ton at the mill, was $36.00; in 1916 it was $42.00; in 1917, $60.00; in 1918, $90.00 and in 1919 post-war conditions have permitted bringing down the price of girder rail only to the level of 1917.

Further, any considerable reduction in price is hardly to be looked for, when British municipal tramways are compelled to buy in America because our prices, high as they necessarily appear, nevertheless are below those of British makers.



Installation of Abbott Plate with hook lug. Joint held by common spikes and plate by screw spikes.

The actual increase in the cost of girder rail is, of course, greater than the increases in cost per ton because the weight per yard has gone up with the years, aside from the cost of heavier foundations and higher prices for track fittings. But

Heavier Rail Sections and Firmer Foundations Have Not Prevented the Shortening of Rail Life From Corrugation

Although no one cause is wholly responsible for rail corrugation, it is certainly promoted by any break in continuity or smoothness of running, whether this be due to hard spots in the head of the rail or to ridges at battered rail ends. Every bump is a starting point for the series of hillocks and valleys that under the general name of corrugation are liable to produce rapid destruction of track and foundation, let alone the discomfort to passengers, the noise to neighbors and the deterioration of rolling stock.

To approach the ideal of having your rails *wear* out instead of being *ground* out in one fourth the time, you must begin with bumpless track; and a bumpless track must begin at the *joints*.

Abbott Rail-Joint Plates Minimize Corrugation By Assuring Stronger, Smoother Rail Joints

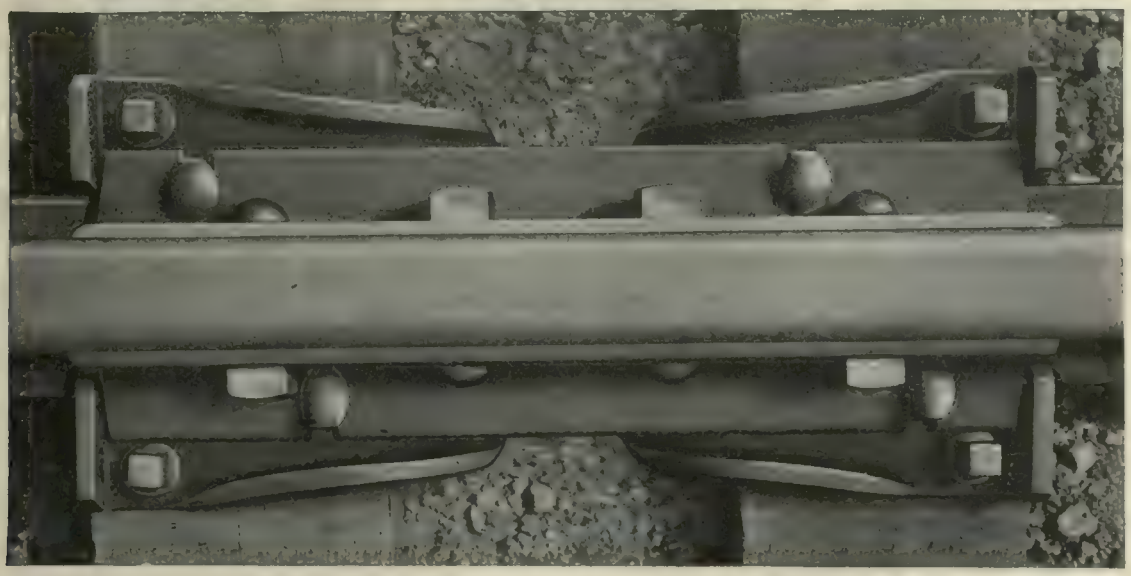
The reinforcement given to ordinary angle or bar joints through the addition of the Abbott Plate is so great that rail deflection or distortion under load is immediately corrected; the stretching of bolts and the loosening of nuts is minimized by relief from excessive strains; the joints are prevented from creeping off the ties; and the ties themselves are protected by wide flat end bearings which serve as tie plates.



Standard pattern Abbott Rail-Joint Plates installed with 80-lb. rails and 24-in. angle bars. Made to fit any length splices from 22-in. to 30-in. and any weight of rail from 50-lb. to 100-lb. per yard.

THE ABBOTT RAIL JOINT PLATE

"BUILT LIKE A BRIDGE"



An installation of the Abbott Joint Plates with hook lugs, showing how the hook lugs engage the gauge side of rail (below). Note absence of contact between the four plate-holding spikes and the angle bars. The rail is of 100-lb. section, with 24-inch joint and the plate has about 90 square inches of flat bearing on each joint tie.

In fact, this plate, which is a deck girder bridge in miniature with the two joint ties acting as piers, gives to every joint a degree of strength that will long postpone the loosening of the joint structure even if corrugation should arise from some other cause such as car trucks out of square.

Send for our book on "Improved Track Appliances" which not only describes the Abbott Rail-Joint Plate in all its forms but also other Lackawanna specialties of interest to every way engineer and electric railway manager.

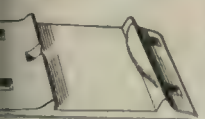
Other Lackawanna Aids to Better Track

he Lackawanna Safety-Head Angle Bar



overcomes liability to wear and fracture by preventing cutting of the bar at the top from back action or upward thrust of the rail ends. This is accomplished by a slight depression in the head of the angle bar for a short space at the center where the rail ends meet.

The Lackawanna Hook-Shoulder Tie Plate



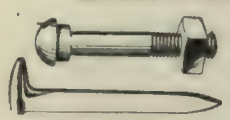
is simple, strong, durable, convenient for installation, and by holding the rail with great security prevents undue wear and destruction of material, saves repair costs and reduces maintenance labor.

Two ribs on top form a channel in which the rail base rests. One of the ribs is plain and the other hooked to make a holder. One or two plain spikes on the plain rib complete bond between plate and both rail flanges. The plate is fastened to tie by independent plain or screw spikes. The rail may be removed out disturbing the plate.

The Lackawanna Deseaming Process

to which all our rails are subjected, leaves the rail head and base free from the cracks and weak, streaky, laminated, partially decarburized metal that under the ordinary manufacturing processes is an inherent cause of undue surface wear and rail fractures.

Lackawanna Track Bolts and Spikes



Our track bolts and spikes of all standard sizes for light or heavy rails enjoy an enviable reputation for careful, accurate workmanship and finish.

Write for our booklets, "Lackawanna Deseamed Rails," "Lackawanna Improved Track Appliances," and "Lackawanna Track Bolts and Spikes."

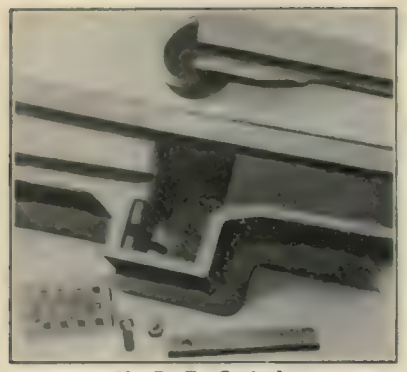
Lackawanna Steel Company

General Sales Office and Works: Lackawanna, N. Y.

Atlanta Boston Buffalo Chicago Cincinnati Cleveland Detroit New York Philadelphia St. Louis San Francisco

Sole Exporter of Our Commercial Products: Consolidated Steel Corporation, 165 Broadway, New York.

457



H. C. B. Switch

WHARTON SPE

SWITCHES
MATES
FROGS
CROSSINGS

Solid Manganese Steel and Manganese Steel Insert

Converter and Electric Steel Castings
Hammer and Press Forgings *Seamless Steel Gas Cylinders*

WM. WHARTON, JR. & CO., INC.

EASTON, PENNA.

"Originators of Manganese Steel Track Work"

SALES OFFICES:

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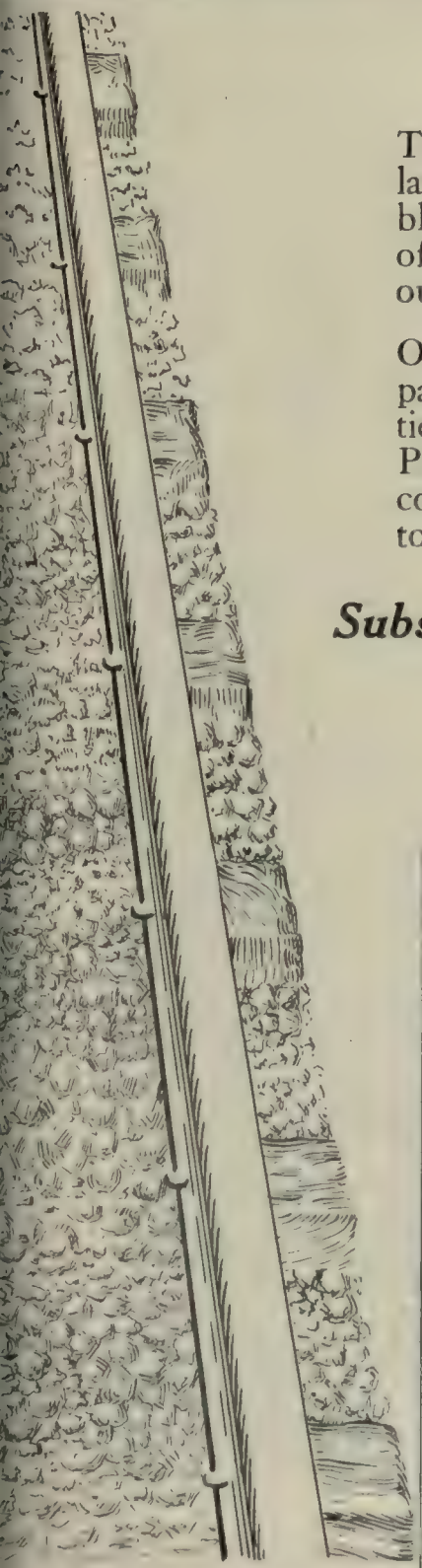




L TRACK WORK



"GIANT HEEL" Switch



The illustration below gives a comprehensive view of our large Layout Yard, where Special Track Work is assembled and carefully fitted together, to avoid any possibility of trouble during installation. No piece of work leaves our plant without such careful fitting.

Our extensive, modern plant, illustrated on the preceding page, is equipped to fabricate track work of all constructions, Solid Manganese Steel, Manganese Steel Insert, Plain Bolted and Manganese Steel "T" Rail, etc., which coupled with our long experience, places us in a position to supply your needs efficiently.

Subsidiary of Taylor-Wharton Iron & Steel Co.

High Bridge, N. J.

Other Plants:

TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
PHILADELPHIA ROLL & MACHINE CO., Philadelphia
TIOGA STEEL & IRON CO., Philadelphia



MAINTENANCE

Maintain Your Service

Provide Against Interruptions to Your Power

Sectionalize Your Lines—

Use Type "B" Air Brake Switches

Provide Lightning Protection for Your Power Circuits—

Use "WB," "WBR" Lightning Arresters

Provide Lightning Protection for Your Trolley Feeders—

Use New Form 4 Type "S" for 600-Volts D.C.

Have a Stand-by for Your Converter Equipment—

Use Portable Sub-stations

Bulletins on Request

RAILWAY & INDUSTRIAL ENGINEERING COMPANY

Main Office and Works: Greensburg, Pa.

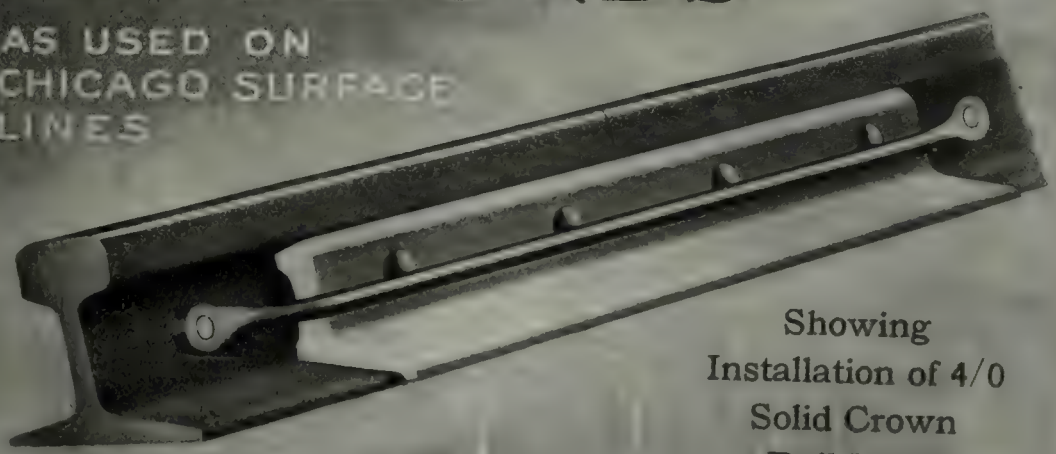
NEW YORK
2 Rector Street

PITTSBURGH
Peoples Bank Bldg.

CHICAGO
602 Monadnock Bldg.

CROWN
RAIL BONDS

AS USED ON
CHICAGO SURFACE
LINES



Showing
Installation of 4/0
Solid Crown
Rail Bond
Applied Around
the Joint



Made by

American Steel & Wire Company

Chicago New York Cleveland Pittsburgh Denver

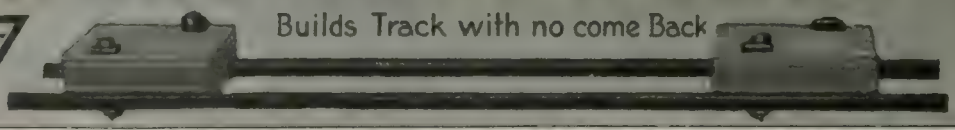
United States Steel Products Company

Pacific Coast Dept.: San Francisco, Los Angeles, Seattle, Portland

Export Department: 30 Church St., New York

The RESILIENT RAILWAY TIE

Builds Track with no come Back



TO Avoid Both Noise and Destruction You Must Attain,

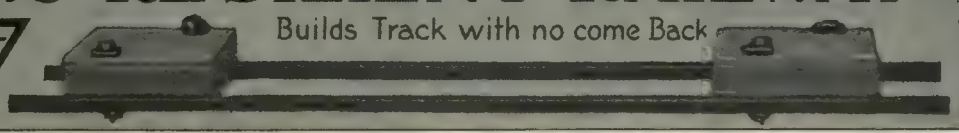
Resiliency

It is a well-known fact in accoustics that diversity of materials breaks up the transmission of sound waves and so diminishes noise. That is one reason why the blend of steel, concrete, wood and asphalt used in the Dayton Mechanical Tie helps to give a quiet track.

THE DAYTON MECHANICAL TIE CO., 704 COMMERCIAL BLDG. DAYTON, OHIO

The RESILIENT RAILWAY TIE

Builds Track with no come Back



IF the elimination of noise is not a sufficiently good reason, consider that this very noise is evidence that destructive forces are at work. A noiseless impact means an impact whose destructive powers have been absorbed exactly as its audible manifestation has been absorbed. In brief: A noiseless track is a long-lived track, because the materials of which it is composed possess the necessary

Resiliency

THE DAYTON MECHANICAL TIE CO., 704 COMMERCIAL BLDG. DAYTON, OHIO

A 4-Fold
for Rec

1

Apex Rail Joints

Conductivity 38% greater than unbroken rail.

Maximum deflection under maximum wheel (Robert W. Hunt & Co. test.) only .018 inch.

These figures are backed up by satisfactory installations on more than 100 electric railways.



"APEX" Joint for Guard and Girder Rail

No Bolts—No Bonds—
No Maintenance

2

Indianapolis Electric Welder

Maximum amount of welding at minimum cost.

Furnished on the "pay-as-you-save plan."



Indianapolis Switch

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Service

mation

Indianapolis Composite Eye Lenses



Composite eye lenses—the latest development—absolutely excluding all violet rays.

Indianapolis Fluxated Welding Steel



Claims for highest efficiency backed up by laboratory and government tests. Perfect welds an asset—poor welds a liability.

TEST RESULTS

No. 1—I. S. and F. Fluxated Welding Steel.
Tensile strength 56,000 pounds per sq. in., weld very good.

No. 2—I. S. and F. Fluxated Welding Steel.
Tensile strength 70,000 pounds per sq. in., weld very good.

No. 3—I. S. and F. Fluxated Welding Steel.
Tensile strength 39,000 pounds per sq. in., weld good.

No. 4—I. S. and F. Welding Steel—Not Treated.
Tensile strength 35,000 pounds per sq. in., weld fair.

No. 5—Commercial Welding Wire.
Tensile strength 23,000 pounds per sq. in., weld poor.

No. 6—I. S. and F. Welding Steel—Not Treated.
Tensile strength 32,000 pounds per sq. in., weld coarse.

No. 7—Commercial Welding Wire.
Tensile strength 27,000 pounds per sq. in., weld very coarse.

& Frog Company

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ST. LOUIS FROG & SWITCH CO
ST LOUIS, MO.

for
Successful
Track Construction
and
Economical
Maintenance

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Information That Can't Be Bought

Our 280 page handbook of Track Construction and Maintenance contains original data and tables to be found nowhere else. In addition there is provided material from standard works, making it the most complete reference work for a wide range of track problems.

Convenient size, 5 x 7 inches, cloth bound, with over 200 designs, diagrams and illustrations.

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THE SPEEDSTER for very rapid continuous service rehandling.

THE BULLDOG, the most powerful standard clamshell on the market, for excavating and for handling slag and other refractory materials. THE POWER WHEEL of the bull-wheel type for general rehandling and digging. Made only in smaller sizes. THE SINGLE LINE for continuous or intermittent service on single or multiple drum rigs and cableways. Made in various sizes and styles for digging and handling all kinds of materials from sand to skull cracker pit slag.

Put your bucket problems up to the Blaw-Knox engineers. They will study them and recommend the bucket which meets your particular requirements. Write for literature.

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605 Farmers Bank Bldg., Pittsburgh, Pa.
NEW YORK 165 Broadway BOSTON Little Bldg. CHICAGO Peoples Gas Bldg. DETROIT Lincoln Bldg.
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BLAW BUCKETS FOR EVERY KIND OF SERVICE



These Products are Built and Trade-Marked by Blaw-Knox Company

BLAW STEEL FORMS for all kinds of concrete construction, from sewers to subways, from sidewalks to skyscrapers.

BLAW CLAMSHELL BUCKETS and Automatic Cableway Plants for digging and handling.

FABRICATED STEEL.—Manufacturing plants, bridges, crane runways, trusses, standardized sectional steel buildings, etc.

KNOX PATENTED WATER-COOLED APPLIANCES for open-hearth, glass, copper regenerative and sheet and pair furnaces.

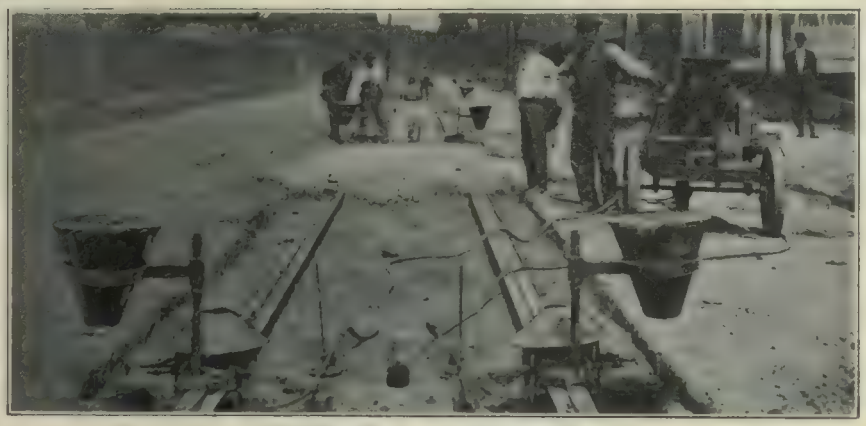
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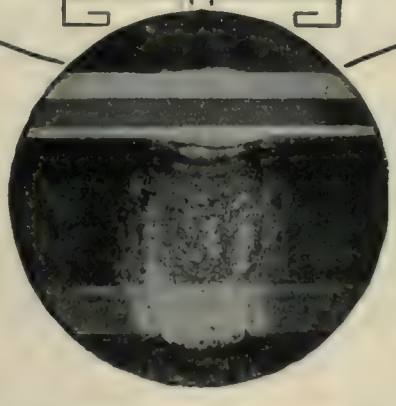
TRAVELS TO TOWNS WHERE THERMIT INSERT RAIL WELDING TERMINATED TRACK TROUBLES





Preheating rail ends preparatory to welding.





FALL RIVER

The New Englander is characterized by his *thrift*, and other sterling qualities which make him *wear well*.

The THERMIT INSERT RAIL WELD is also characterized by the *thrift* in rail maintenance which its installment in paved track produces, and for its *smoothness* and *high mechanical strength*, which make it *wear well*, without cupping.

Birds of a feather flock together! That's why an initial installment of 400 Thermit Insert Welds was ordered last Fall for the track of the Eastern Massachusetts Street Railway at Fall River, and elsewhere on its system, this being about as many welds as they could make before the cold weather put an end to the welding season.

Send for Railwelding Pamphlet 1232

METAL & THERMIT CORPORATION

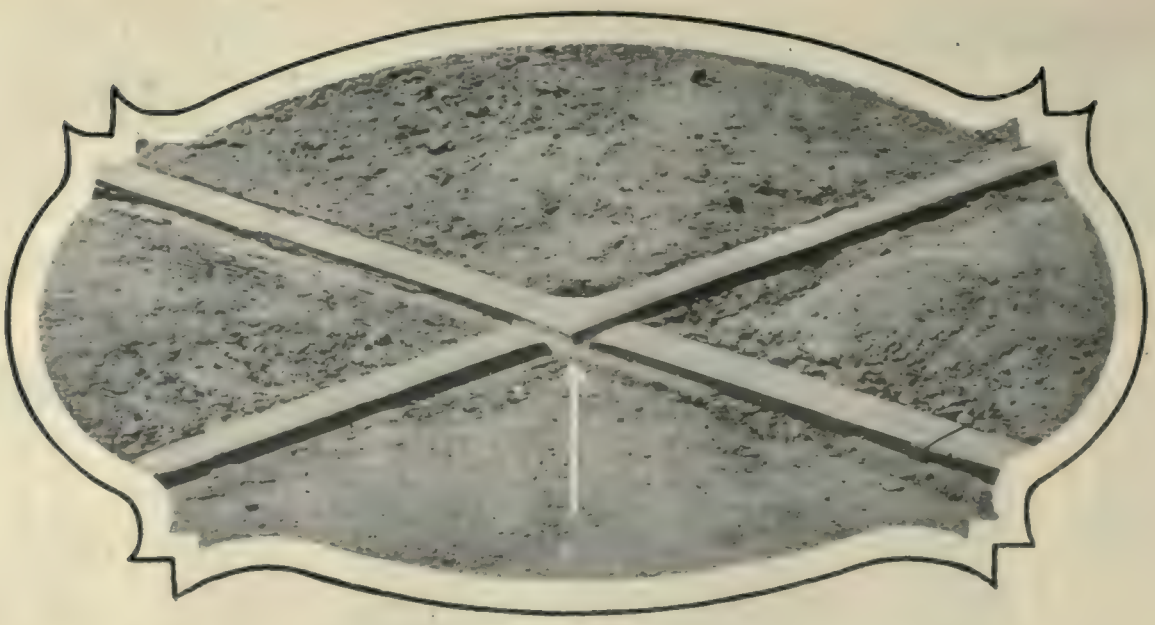
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Pittsburgh Toronto



"Next Stop, Baltimore!"



Thermit-Welded Special Work Will Reduce the Highest Item of Your 1920 Budget

When you made up your budget for 1920, many, many thousands of dollars went into contemplated renewals of special work—anywhere from $2600 for a simple, hard-center cross-over that you paid only $1200 for before the Great War to such a staggering sum as $50,000 for a complicated layout.

But now, with our five years of experience in Thermit-Welding special work to back us up, we are going to ask you to scan that budget again for a welcome revision downward!

With the Promise That Thermit-Welded Special Work Will Reduce Later Budgets, too

The cheering fact is that it is no longer necessary for you to buy extremely costly yet uncertain special work or, failing that, to go to the other extreme of making cheap but short-lived, built-up bolted work at home.

Thermit-Welded Special Work combines the durability of the costliest construction with the low first cost of the ordinary built-up job. Through the obliteration of the joint effected only by Thermit-Welding, there is obtained the smooth, thorough-running trackway that makes long shock buffers or inserts of high-priced manganese unnecessary.

Thermit-Welding also Has Proved Entirely Successful on Chrome Nickel

as shown in the accompanying illustration of chrome nickel electric frogs, which were welded into a half crossing by a Western railway. In this job the rail arms of different unit frog pairs were welded together, instead of the crosses themselves, so as to form a half crossing from four units. The satisfactory performance of this piece shows that Thermit welds can be made as successfully on alloys like chrome nickel as on ordinary steels.

Just advise us what rail sections you use and how many crossings of each you wish to make, and we will quote you prices at once. The permanent Thermit equipment, costing less than $150, *can also be used for welding compromise joints, broken motor cases, truck frames, armature shafts or other heavy steel sections.*



Metal & Thermit Corporation

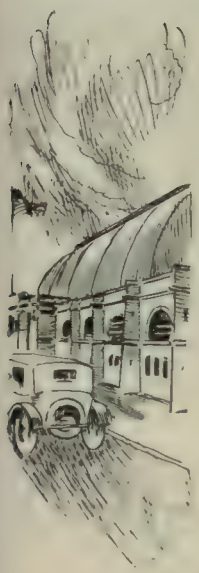
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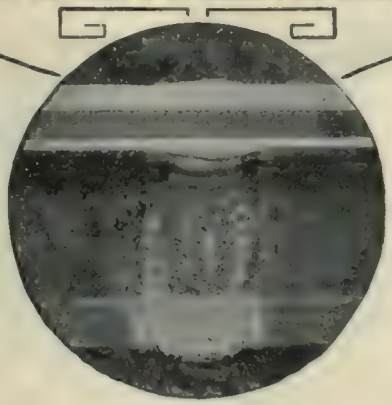
TRAVELS TO TOWNS WHERE THERMIT INSERT RAIL WELDING TERMINATED TRACK TROUBLES





Thermit Insert Rail Welding by the Baltimore & Ohio Railroad, Baltimore.





BALTIMORE

The THERMIT INSERT RAIL WELDS in Baltimore hold the record in having been installed in the heaviest rail, so far as we know, that has ever been welded.

The Baltimore & Ohio Railroad, one of the pioneer users of Thermit in railroad shops, in 1917 adopted the Thermit Insert Weld for the type of rail joint to be used in one of the Baltimore water-front streets where a heavy steam railroad traffic is carried on.

The entire installation comprised about 250 joints between P. S. Co. rails of section 141-263, an exceptionally heavy rail weighing 141 lbs. to the yard.

An inspection of these Thermit joints, two years later, showed them to be in as fine a condition as ever; *no cupping;* just like all the other Thermit Insert Joints all over the country.

Send for Railwelding Pamphlet 1232.

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"Next Stop, Pittsburgh!"



THERMIT-WELDED Special Work

Good for any Cars, But Great for Safeties

For most of our cities, the day of the 35,000 lb.-50,000 lb. street car is waning.

With that day is waning also the enormously costly solid manganese special work, the frequent re-alignments and the excessive bills for repairing paving.

You don't have to wait for light-weight, safety-car operation, however, to enjoy the savings that these 15,000-lb. cars will bring to the way department. You can begin today by ordering a Thermit Welding equipment that will enable you to make up your own boltless, jointless special work at a welding cost of a few hundred dollars per job on whatever rail—plain or alloy—that you choose to use for your intersections.

From five years' operation under double-truck cars operated down to 30 seconds headway, we know that Thermit-Welded frogs and crossings can stand the pounding of the heaviest cars without deterioration. So that when you begin operating your light-weight safety cars,

THERMIT-WELDED Special Work

Will Give You Extremely Long-Lived Work at Lowest Possible Prices

Just advise us what rail sections you use and how many crossings of each you wish us to make, and we will quote you prices at once. The permanent Thermit equipment can also be used for welding compromise joints, broken motor cases, truck frames, armature shafts or any other heavy steel sections.

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"HOW DOLLARS ARE LOST!"

This article was abstracted, with permission, from a publication of The Electric Service Supplies Co., Philadelphia

"If it is not your policy to regularly and systematically test your rail bonds then the following will show you clearly and conclusively just how much money you can save by adopting a regular and systematic manner of bond testing; and with this as a foundation keeping your track return up to the standard maintained on your other equipment.

For purpose of illustration, a railway 5 miles long, single track, has been selected. This is laid with 30-ft. 70-lb. A.S.C.E. rails, the steel of which has a resistance 13 times that of an equivalent copper section. It is bonded with 4.0 bonds, 12 inches long, having terminals ¾-in. in diameter.

In transmitting electrical energy we know that resistance causes a certain loss; for our assumed case, we shall consider only the losses in the track return. This depends on the resistance, the current flowing, and its voltage. The resistance is made up of the resistance of the rails themselves, of the bonds themselves, and of the bond contact resistances.



Our bonds at 75 deg. F. have a resistance each of .00004968 ohm; the contact resistance will average .0000015 ohm per contact; the resistance of the rail per mile is .08298 ohm. We know that the fish plates themselves will carry a certain current between rail and rail, and we will assume that this conducting path averages in conductivity 10 per cent of the conductivity of unbroken rail.

With these figures at hand, and assuming the track to be well cross-bonded, we can easily calculate the total resistance of the track return to be .2178 ohm.

In order to simplify our calculations we will assume that the rails are laid on rock ballast, or on dry sandy soil, and under these conditions we can neglect the conductivity of the earth as a return conductor. And, speaking generally, modern railway construction is such that much care is taken to prevent current leaving the rails and returning to the power station via the earth, hence eliminating the troubles which otherwise would be caused by electrolysis.

Now suppose the return current averages 500 amperes; average voltage 600; current flowing 18 hours per day, 365 days per year; and that power on the trolley costs two cents per kilowatt hour.

The annual loss due to resistance in the rail return will amount to $7,154.72 of which $6,585.12 is chargeable to the resistance of the rails themselves and $569.56 is chargeable to the resistance of the bonds.

These are fixed losses, losses which cannot be reduced under the assumed conditions of operation; and when the losses in the track return do not exceed these figures, the track return with its single bonding may be said to be in perfect condition.

At this point let us assume that the total cost of replacing the 1,758 bonds used in this five miles of single track at $0.75 each, including the cost of the bond itself, is $1,318.50.

With our track return in perfect condition, the resistance of each bond, including contact resistances, and assuming 10 per cent conductivity of the fish plates, will be equivalent to 2.51 feet of unbroken rail."

Let us, as a first assumption, assume that from a bond test, we have found the bond resistances due to poor contacts, broken strands, etc., have increased to an average of 10 feet of unbroken rail.

This slight increase in resistance has increased the annual loss in the bonds themselves $1,698.58 over the normal or fixed loss.

Or again, assume that the resistance of the bonds has increased to an average of 20 feet of unbroken rail.

This increase in resistance has increased the annual loss in the bonds themselves $3,966.72 over the normal or fixed loss.

Or again; assume that the resistance of the bonds has increased to an average of 30 ft. of unbroken rail.

This increase in resistance has increased the annual loss in the bonds themselves $6,234.86 over the normal or fixed loss.

Specify the Roller-Smith Bond Testers—*the standard of the world*—and see that you get them..

Send for Bulletin G200-201

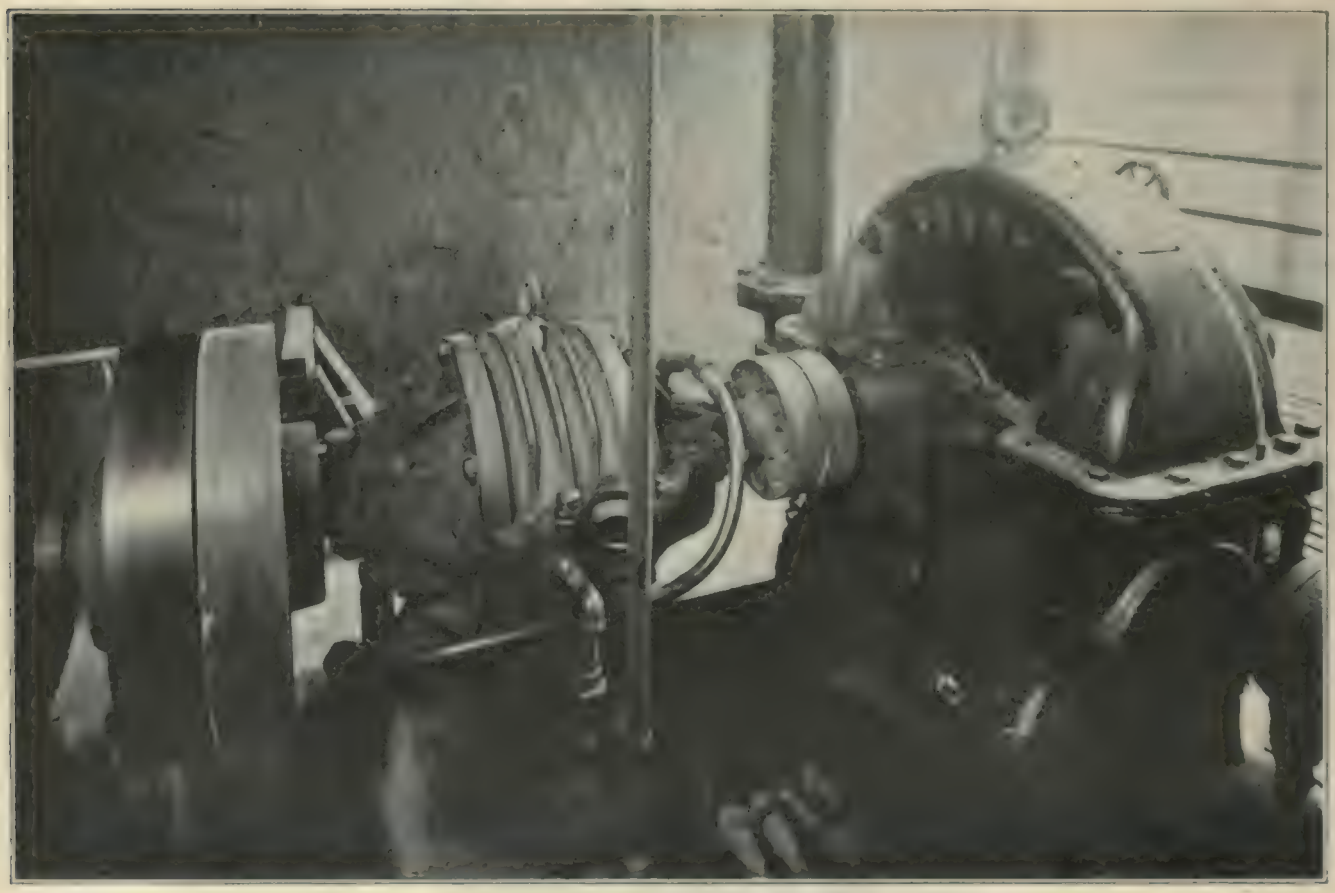
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The Ideal Auxiliary Drive

In driving auxiliaries it is essential that the transmission provide a constant dependable torque, without loss of efficiency.

Turbo-gear is pure torque transmission. Its efficiency is guaranteed 97%.

The turbo-gear in the above photograph is driving a No. 14 D. I. type H. S. American Blower Company's fan with a speed reduction of 4 to 1 from a 75 h. p. Terry steam turbine. The installation is in a large Southern Iron and Steel Mill.

It has been quite satisfactory.

Its upkeep has been "none."

Perhaps you have auxiliaries which could employ this ideal auxiliary drive.

May our engineers study your needs?

POOLE ENGINEERING & MACHINE COMPANY

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for railway shop, power plant and rolling stock

Texaco Lubrication Engineers will gladly assist you in selecting the right Texaco Lubricants for your shop—power-plant rolling stock, or any other equipment.

You may call upon them to make a survey of the equipment if necessary. This is Texaco Service—there is no charge.

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A Real Textbook

which, besides containing full details and prices on I-T-E CIRCUIT BREAKERS, describes many new labor-saving applications that are of interest to every engineer.

We believe that this handbook will be found so authoritative that it will bear the same relation as a textbook that CUTTER apparatus does in electrical installations.

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Between the Fuel Gate

And the Discharge

WHAT HAPPENS?

AS every engineer knows, the value of a stoker is largely determined during that all-important period when green coal is converted into ash. During this time clinker is formed, or is not formed; fuel yields the greatest number of heat units, or is partly wasted; labor is conserved or unnecessarily called upon. The principle of combustion that governs this stage should be one of the chief considerations in selecting a stoker.

All of the refinements in the furnaces and settings of Green Chain Grates and every one of the improvements in air sealing, have been made to heighten the inherent advantages of the process of burning coal known as PROGRESSIVE COMBUSTION.

When fuel enters the furnace it is immediately ignited, right at the fuel gate, by heat rays reflected and deflected by the GREEN SEALFLEX ARCH.

Since the grate chain is *progressing*, the *path* of ignition is diagonally through the fuel (as illustrated above) until the grate surface is reached. Combustion then *progresses upward* until all of the fuel is consumed.

As a result, *ash is always at the bottom of the fuel bed—never in the hot region of the furnace.* It cannot *melt and form clinker.*

This means that the ash formed on the Green Chain Grate during the vital period of combustion, *never reaches the clinker stage.*

Naturally labor is *not* called upon to clean fires of clinker. Obviously efficiency does *not* slump while fires are being cleaned, and of course steam-consuming sidewall steam jets are rendered unnecessary.

As its name implies, "Progressive Combustion" is one of the main topics of the new Green Book, "PROGRESSIVE COMBUSTION"

Write for your copy to Dept. C on your business stationery

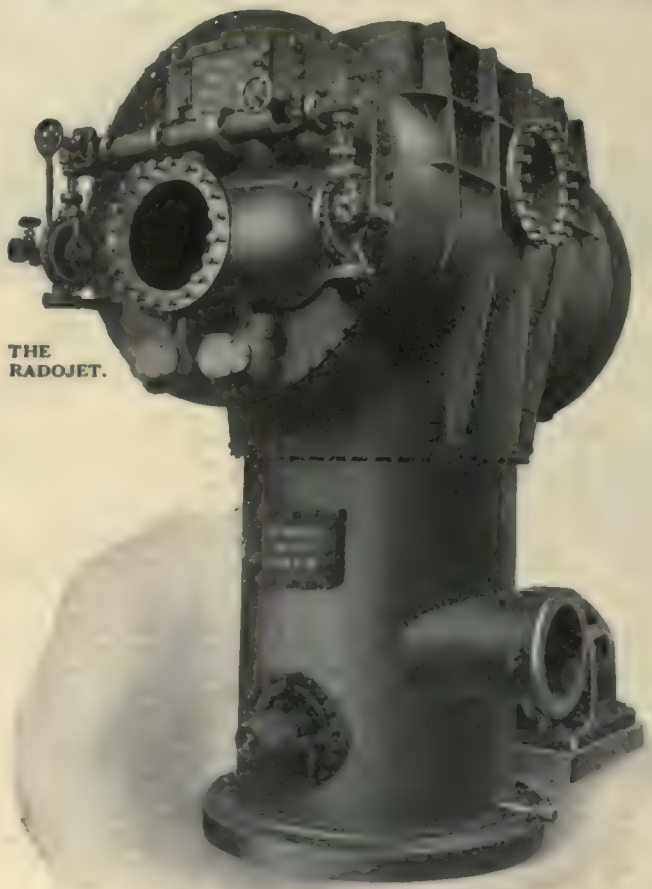
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GREEN CHAIN GRATES

Modern Condensing Equipment For A 7500 Kw. Steam Turbine



THE RADOJET.



RADOJET AIR PUMP

Comparison of the Old Style Vacuum Pump with the RADOJET

Rotative Dry Vacuum Pump—floor space 10 ft. x 22 ft.....weight 31,000 lbs.
Hydraulic Type Vacuum Pump—floor space 5 ft. x 10 ft.....weight 6,300 lbs.
RADOJET Ejector Air Pump—no floor space.....weight 450 lbs.

No foundations—no moving parts—no oiling—no maintenance

RADOJET EJECTOR AIR PUMPS

Nearly 5,000,000 H.P. Sold

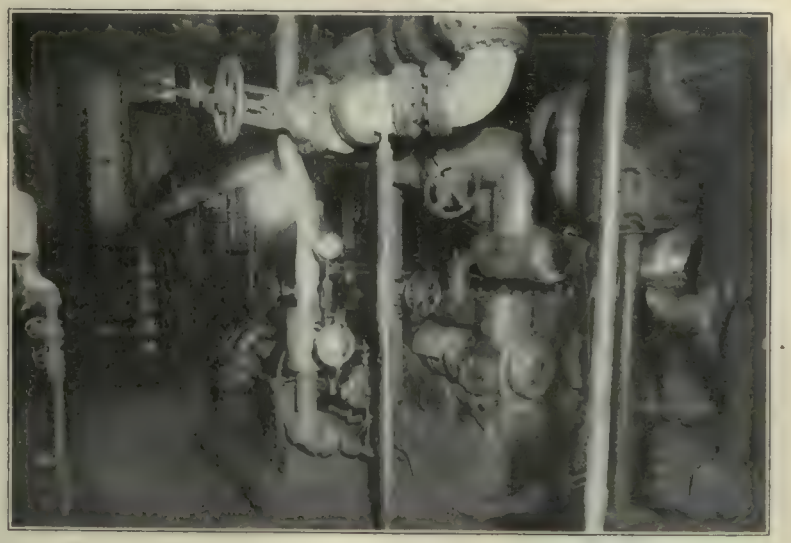
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We specialize in Condensing Apparatus of every description

C. H. Wheeler Manufacturing Co.

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IF you are in need of a reliable prime mover for boiler feeding apparatus you want a machine which will give long, uninterrupted service, one which will be free from exorbitant upkeep cost and which will operate at a high efficiency day in and day out with complete reliability.

THE TERRY TURBINE

is ideal for maintaining these standards, and has proven its worth in many of the most prominent plants throughout the country.

The illustration above shows the Terry Turbine driving a two stage centrifugal pump which feeds five 600 horsepower boilers at the Bay State Street Railway Company's plant at Lowell, Mass.

Engineer William Rounds, into whose keeping this Terry has been delivered, states:

"The machine was placed in service twelve years ago, and has given perfect satisfaction with very little repair cost ever since."

A similar performance in your plant would save you money.

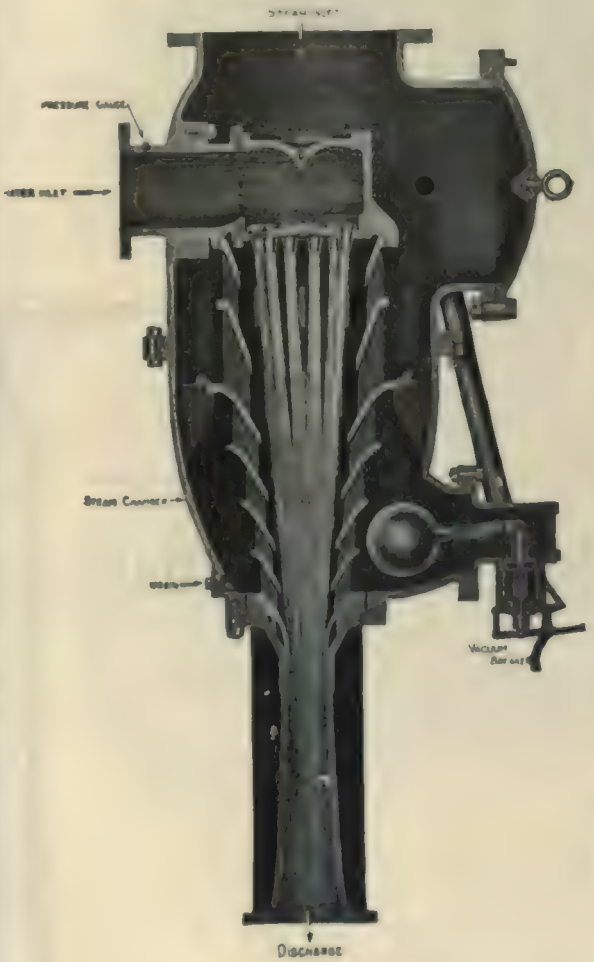
Ask our engineers to explain.
Write for Catalog No. 251 and "Specify Terry"

The Terry Steam Turbine Co.
Terry Square, Hartford, Conn.



For Boiler Feed Service

Steady High Vacuum Without An Air Pump



KOERTING Multi-Jet Condensers need no separate air pump. The air and non-condensible vapors are continuously ejected by means of water jets, which also serve to condense the steam.

A standard centrifugal pump delivering the injection water at a pressure of nine lbs. constitutes the only auxiliary.

The simple design and rugged construction insure uninterrupted service under the severest conditions.

Installed in many leading railway plants and central stations.

Complete condensing equipments up to 10,000 kw. capacity can be furnished to requirements.

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Spray Nozzles
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Oil Burning Equipment
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Elesco Superheaters for Stationary Boilers



The Power Plus of ELESCO Superheat

HIGH superheat is the force which adds sufficient extra capacity to a steam locomotive to enable it to pull a heavier train on a faster schedule. It is the force which adds more miles per ton of coal—which leaves more coal in the tender at the end of the run—which makes necessary fewer stops for water.

This same force applied to stationary power plants by means of the Elesco method adds capacity to your plant or reduces your coal bills.

Superheating leaves a supply of fuel where before there was a shortage.

It is a power which improves the efficiency of your entire plant.

Let us explain in detail how the Elesco method of superheating will accomplish these results for you.

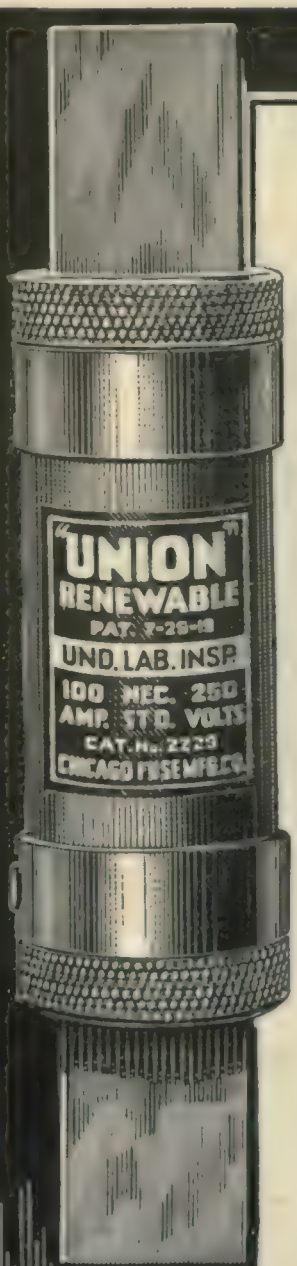
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Designing Engineers and Manufacturers of Steam Superheaters and Pipe Coils for All Purposes.

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Pittsburgh: Oliver Bldg. **Chicago: Peoples Gas Bldg.**



The Only Renewable Fuse Approved by the Underwriters that has A Vanishing Link

"Union" *Renewable* Fuses have won a great victory: Years of research and tens of thousands of dollars have not been expended in vain in our efforts to give the public a *renewable* fuse that is safe and dependable and that will cut down fuse maintenance costs as much as four-fifths in many instances.

"UNION" *RENEWABLE* FUSES

are the only fuses equipped with a vanishing link—the very *center* of which melts when it blows. That means that when this link blows the heat and gases are such a distance from the metal parts that there is no danger of fusing the nuts or corroding the metal parts so as to make it difficult or even impossible, to remove them when renewing the link. And when this link blows there is no flash or violent explosion to injure the casing.

These are some of the reasons why "Union" Fuses have such an exceptionally long life, and why they are so easy to renew. Go to your electrical dealer and see for yourself the big advantages possessed by "Union" Fuses.

Without obligation, our nearest branch will send you booklet and advise you how to reduce your fuse maintenance cost.

Chicago Fuse Mfg. Co.

Oldest and largest manufacturers of Fuses, Electrical Protecting Materials and Conduit Fittings

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UNION

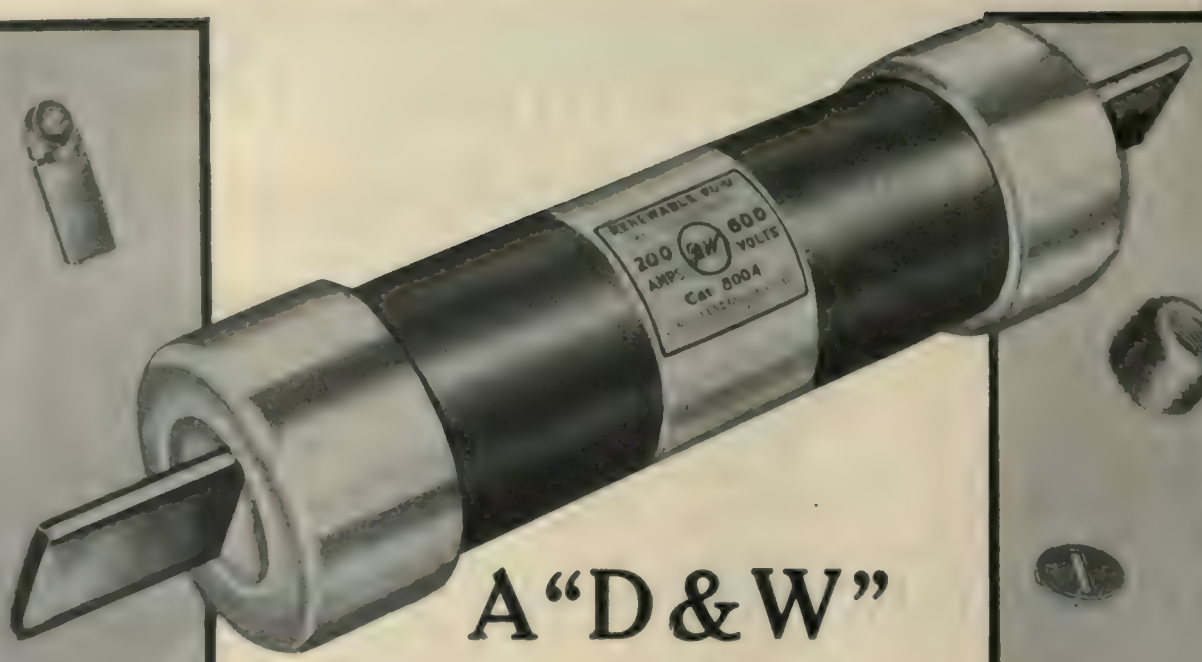
We cannot emphasize too strongly the close examination of the material you receive.

Just to order DURADUCT is not sufficient—as an inferior product may be substituted.

That's why we are so emphatic in telling our friends to be sure the non-metallic conduit they use has a single wall, a "roller-bearing" wireway, and a black dotted line inside.

It pays to have a responsible man check this up.

Tubular Woven Fabric Co.



A "D & W" Feature

The expulsion or "Jacketed" Fuse Link consists of a flat strip of metal, with the central portion slotted and closely wrapped with a covering of specially treated asbestos.

The "Jacketed" Link by its expulsion action greatly reduces the arc and insures longer life to the fuse casing.

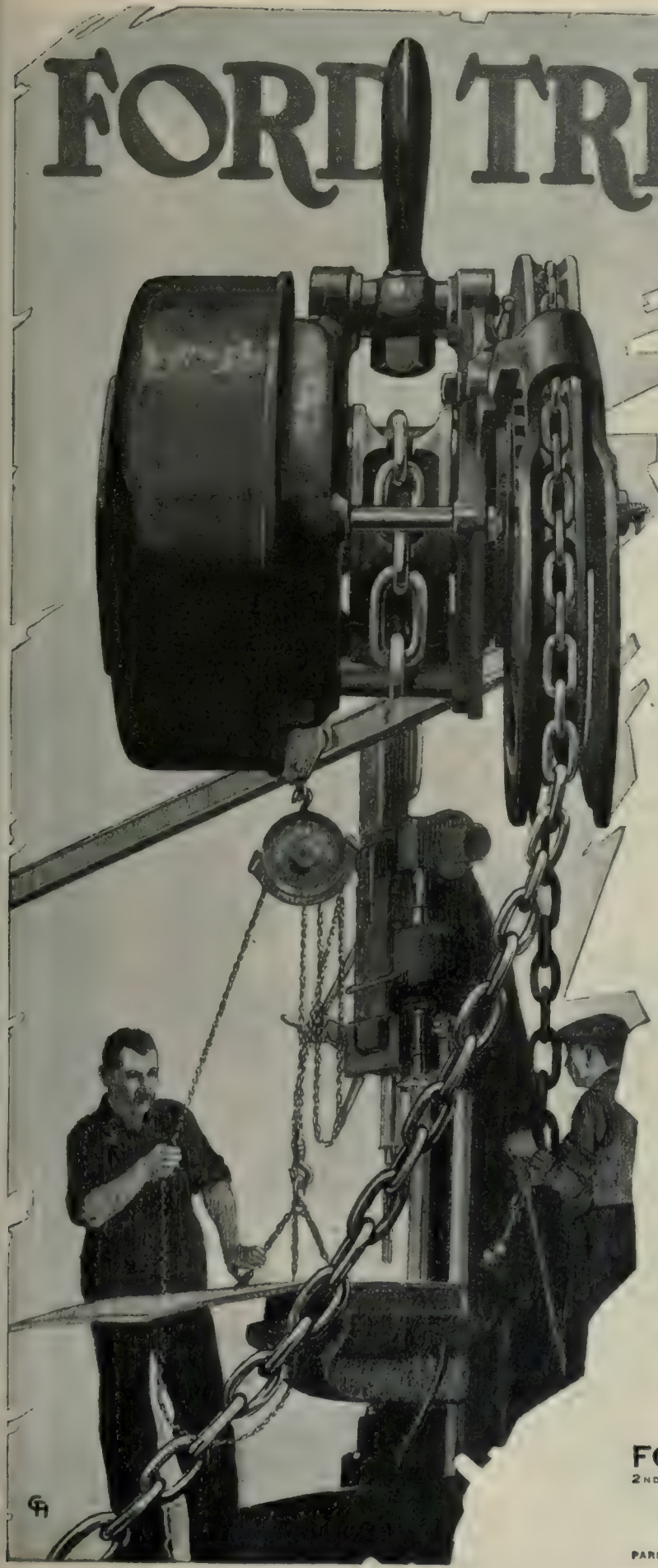
A rugged fuse is most essential in the renewable type, for unless the fuse casing can be re-fused over and over again, the whole object of a renewable fuse is defeated.

"D & W" Renewable Fuses are scientifically designed—easy to load—always aligned.

For complete description write for Catalog No. 16

D & W Fuse Company
Providence R.I.
U.S.A.

FORD TRIBLOC



Built for "Roughing It"

When all attention is focussed on the work being handled, the chain hoist must give no trouble.

Its work is hard and continuous, and unless it has been correctly planned and honestly constructed, it cannot stand the strain.

The FORD TRIBLOC is built for "roughing it." Made by men who know what a hoist must do—it stands up to the daily grind without care or attention.

Steel working parts, carefully tested steel chain hooks, steel planetary gears, and a patented loop hand chain guide are some of its distinguishing features. Capacities: One to Forty tons.

A 5-year guarantee *in writing* is *your* protection.

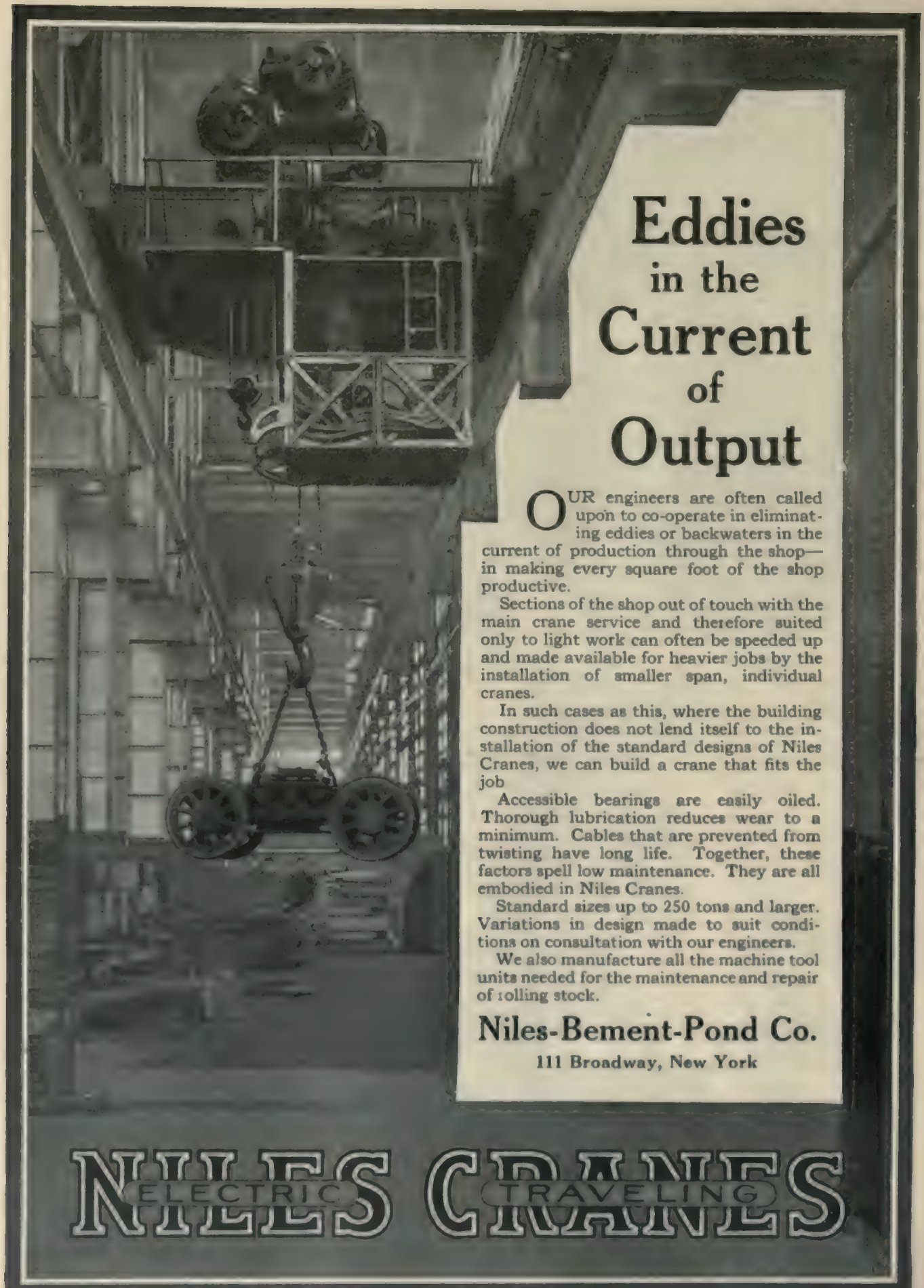
Catalog? Your name and address brings it.

2165-D

FORD CHAIN BLOCK CO.
2ND & DIAMOND STREETS PHILADELPHIA, PA.

OVER SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK U.S.A.

PARIS BRUSSELS TURIN BARCELONA RIO DE JANEIRO



Eddies in the Current of Output

OUR engineers are often called upon to co-operate in eliminating eddies or backwaters in the current of production through the shop—in making every square foot of the shop productive.

Sections of the shop out of touch with the main crane service and therefore suited only to light work can often be speeded up and made available for heavier jobs by the installation of smaller span, individual cranes.

In such cases as this, where the building construction does not lend itself to the installation of the standard designs of Niles Cranes, we can build a crane that fits the job

Accessible bearings are easily oiled. Thorough lubrication reduces wear to a minimum. Cables that are prevented from twisting have long life. Together, these factors spell low maintenance. They are all embodied in Niles Cranes.

Standard sizes up to 250 tons and larger. Variations in design made to suit conditions on consultation with our engineers.

We also manufacture all the machine tool units needed for the maintenance and repair of rolling stock.

Niles-Bement-Pond Co.

111 Broadway, New York

NILES ELECTRIC TRAVELING CRANES

DUFF GENUINE BARRETT JACKS



In Baltimore

The officials of the United Railway & Electric Company are always on the alert for tools which will enable them to handle repair jobs most efficiently. It is not surprising, therefore, that Duff Genuine Barrett Jacks have been selected for use in the repair shops of this company, with results that are stated to be "very satisfactory."

Duff Jacks are made in a wide variety of sizes and styles for electric railway work. There are special types for lifting cars in the shops, with pit jacks for handling axle sets and motor armatures, emergency jacks for relieving tie-ups, and track jacks for maintenance of way.

For many years Duff Genuine Barrett Jacks have been standard tools on electric railways. Their strength, and durability under constant service proves the soundness of their design and the quality of their workmanship.

When you need a jack of any type—emergency, track, armature lift, or repair shop—you need a Duff. Write us for detailed information.

The Duff Manufacturing Co., Pittsburgh, Pa.

New York Chicago Atlanta San Francisco

COLU

PROD

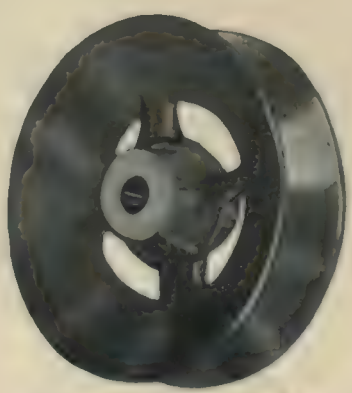


lower your

co



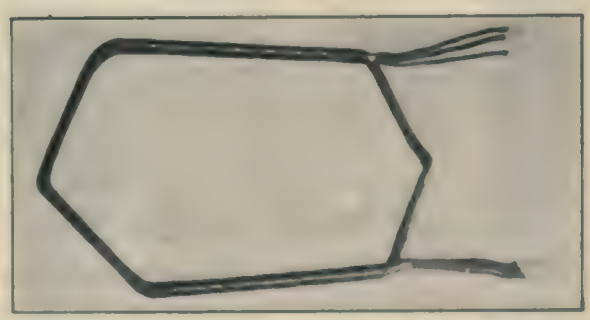
Columbia Bearings



Columbia Trolley Wheel



Columbia Gear Case



Columbia Coil

COLUMBIA MACHINE WORKS

A. A. GREEN, Sales Mgr.,
50 Church St., N. Y. C.

Atlantic Ave., and Chestnut S

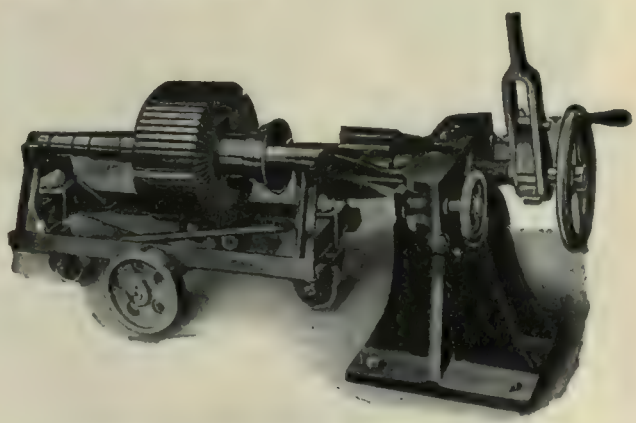
MBIA

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maintenance
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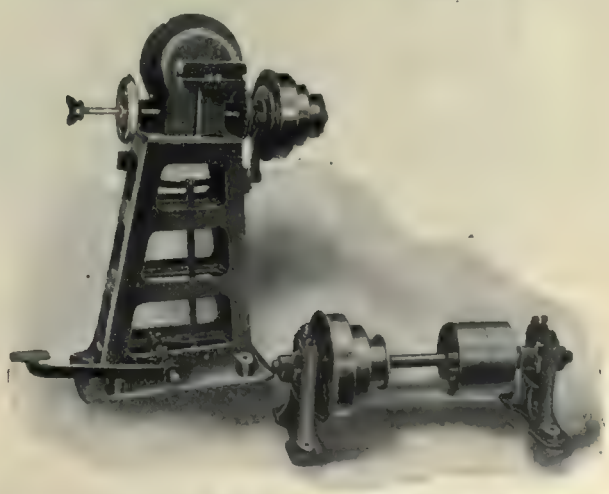
lumbia Armature Banding Machine



Columbia Pinion Puller and Armature Body



Columbia Adjustable Armature Stand



Columbia Field Coil Winding Machine

MALLEABLE IRON COMPANY

Brooklyn, New York

J. L. WHITTAKER,
141 Milk St., Boston, Mass.

BERWICK ELECTRIC

for Electri



No. 2 two-electrode BERWICK ELECTRIC RIVET HEATER, for ½-in. to ⅝-in. diameter rivets, up to 3½-in. long, or longer; capacity 300 or more per hour. Four electrodes give 500 or more hot rivets per hour.

Now you have your choice: Between open fires, with smoke, gas, dirt and intense heat with fire hazards; and an *Electric Heater*, with no objectionable, but with many valuable features.

Which Shall it be?

Is it of value to you to reduce your heating cost from 25% to 70%; to reduce rivet loss from 10% to less than ½ of 1%; to have a portable Heater running within a few feet of the work in hand, and to eliminate in many instances the sticker boy; to get hot rivets in thirty seconds, at any rate desired from 2 to 10 per minute; and to use current only when rivets are desired?

If so

Then investigate the BERWICK ELECTRIC RIVET HEATER which, from our own experience, will save you one dollar on every hundred

Send

AMERICAN CAR

165 BROADW

RIVET HEATERS

Railway Uses

pounds of rivets heated; which requires less than 20 kilowatt hours per hundred pounds of rivets heated; which has been in operation in our own shops at Berwick, daily, for over five years: improved and perfected only to improve our own rivet conditions.

Does the elimination of smoke, gas, dirt, intense heat; oil, gas or air pipes in your plant mean better shop conditions for you?

Think it over; figure your present costs; then write us. Give size of rivets used; approximate hourly requirements; and Alternating Current conditions.

Ten types and sizes of heaters. Absolutely safe; almost fool-proof. Let us serve you.

"National Marine Week" Stands for American Independence on the Seas. Where Do You Stand?

First Maritime Exposition in Twenty Years, April 12-17, Grand Central Palace, New York.

COME FOR PROSPERITY



The Berwick Electric Rivet Heater was built to improve our shop conditions; for several years over 50 have been in daily use. All experimental features have been eliminated. Will furnish a steady stream of properly heated rivets, heat radiating from center outwards.

etails

OUNDRY COMPANY

W YORK, N. Y.

PERFECT
MICANITE
INSULATOR
Reg. U. S Pat. Off

Electrical Insulation for Each Separate Need

Micanite Commutators, Insulators, Tubes, Washers, Rings, Segments, Sheets, Tapes, etc., made of imported mica.

Empire Linseed Oil Treated Cambric, Linen, Silk, Canvas, Duck, Papers and Tubing. High puncture voltage. long life.

Kablak Black Varnished Cambric, Linen, Silk, Canvas, Duck and Papers. Flexible, efficient under high temperature.

Linotape Linseed oil coated tape, both straight and bias cut, for coil winding, cable splicing, bus bars, etc.

Mico Untreated insulating fabrics, Papers, Fibres, Linen Tapes, Sleeving, Shellacs, Cements and Varnishes.

BULLETINS

Send for bulletins covering all these products and cut your maintenance costs.

MICA INSULATOR CO.

Manufacturers

68 Church Street, New York 542 So. Dearborn St., Chicago

Works: Schenectady, N. Y.

Originator, Inventor and Manufacturer of the above products.



Why the H & K Cut-in Back for Wider Aisles?

Because the Torso needs more room than the Legs!

Knowing it is a matter of inches whether aisle space in a cross-seat is made endurable or otherwise for your standing passengers when those Hale & Kilburn Comfort Seats are fully occupied—

We make many types with the cut-in back similar to the No. 109A, shown in the accompanying illustration.

The cut-in back takes advantage of the fact that the lower half of the human body requires less room than the torso or part above the hips. At the same time the fact that the seat-back is slightly narrower than the seat-cushion does not incommode the majority of passengers who need less room at the shoulders than at the hips and thighs when seated. Thus, as in the development of correct-posture seating, the

H & K Cut-in Back

Is an Example of Anatomical Knowledge Applied to Make Scientific Seating Layouts.

WALKOVER COPYRIGHTED

Hale & Kilburn Corporation

Philadelphia New York Chicago St. Louis Detroit
Washington Atlanta San Francisco Dallas Louisville
LONDON G. D. PETERS CO., LTD., 15 DEANS YARD, WESTMINSTER

WALKOVER COPYRIGHTED



50 PASSENGERS PER MINUTE AT SPARROWS POINT, MD.

Perey Turnstiles handle 45 to 50 Passengers per minute at Sparrows Point Shipyards.

The prepayment area of the United Railways and Electric Company at Sparrows Point, Md., is equipped with ten Perey registering turnstiles. The operators receive either cash tickets or fare checks, make change when necessary, and each turnstile is capable of admitting 45 to 50 passengers per minute.

Other notable installations are as follows:

Brooklyn Rapid Transit Company
Des Moines City Railway Company
Emergency Fleet Corporation
Philadelphia Rapid Transit Co.
Public Service Railway Co.
of New Jersey
Tidewater Power Company
Wilmington, N. C.
United R'ways & Electric Co.
of Baltimore, Md.
United Railroads
of San Francisco

It saves money by eliminating breakage and rough handling of equipment. It saves labor. Women operators can be employed. We are prepared to make a study of your operating conditions and fare collection problems. Let us hear from you.





PEREY MANUFACTURING COMPANY, INC.
30 Church Street, New York City



Type R-10—Single Register

Accurate Fare Registration

Don't *guess* at your fare collection. Know.

Swing your fare problem on the highest basis by installing a visible and audible fare registration system. Cars equipped with money counting Fare Boxes need this additional check against the fare box. Where non-registering fare boxes are used the Fare Register is the only method of checking against the fare box.



Type R-5—Double Register

International Fare Registers

have stood the acid test for nearly a quarter of a century. And because of their consistent uniformly high grade service they are accepted as the standard equipment by the leading Electric Railways and City Systems throughout the country.

Exclusive Selling Agents for HEEREN ENAMEL BADGES, International Conductors' Ticket Punches, Car Fittings.

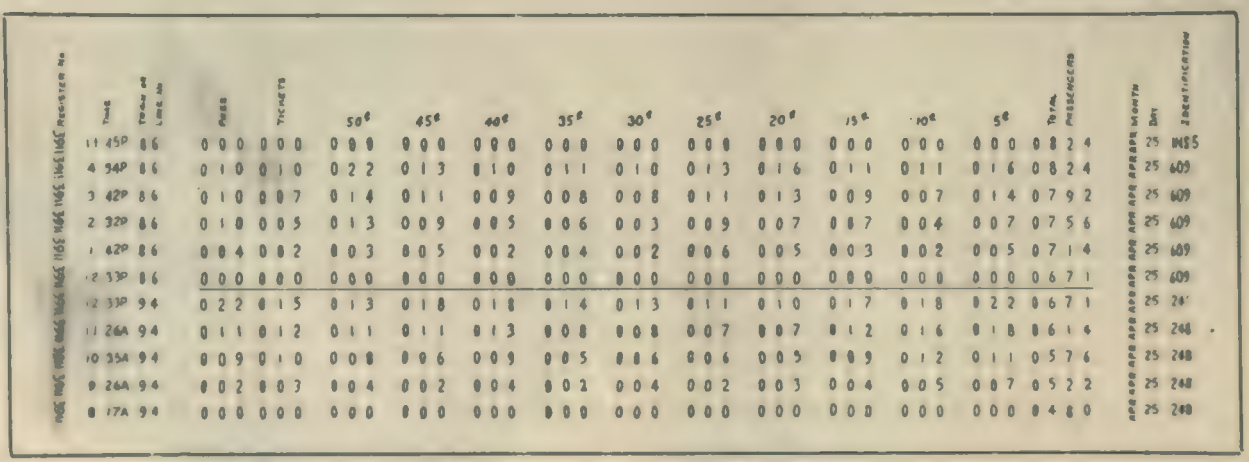
The International Register Company

15 So. Throop St., Chicago, Illinois

Accurate Information

is a fundamental requirement in any business. The money earned, as well as the money spent, must be carefully itemized.

Each fare collected in your cars should be separately indicated, classified, and an unalterable record made at the time and at the place the transaction occurs, *or you are not building on solid ground.*



Time	Trips	Transfers	50¢	45¢	40¢	35¢	30¢	25¢	20¢	15¢	10¢	5¢	Total Passengers	Day	Identification
11 45P	86	000 000	000	000	000	000	000	000	000	000	000	000	0824	25	MSS
4 54P	86	010 010	022	013	010	011	010	013	016	011	011	016	0824	25	609
3 42P	86	010 007	014	011	009	008	008	011	013	009	007	014	0792	25	609
2 32P	86	010 005	013	009	005	006	003	009	007	007	004	007	0756	25	609
1 62P	86	004 002	003	005	002	004	002	006	005	003	002	005	0714	25	609
12 33P	86	000 000	000	000	000	000	000	000	000	000	000	000	0671	25	609
12 33P	94	022 015	013	018	018	014	013	011	010	017	018	022	0671	25	24
11 26A	94	011 012	011	011	013	008	008	007	007	012	016	018	0614	25	248
10 35A	94	009 010	008	006	009	005	006	006	005	009	012	011	0576	25	248
9 26A	94	002 003	004	002	004	002	004	002	003	004	005	007	0522	25	248
8 17A	94	000 000	000	000	000	000	000	000	000	000	000	000	0480	25	248

A Record from a No. 52 Type Ohmer Fare Register

The *Ohmer System* provides complete, printed records of every detail of business done. These records are so clear and compact that the itemized information is at once available for statistical purposes, and by a quick method of analysis, which is a part of the Ohmer System, the characteristic tendencies of each conductor are so revealed that thoroughly effective discipline, based on absolute knowledge of the facts, can be applied.

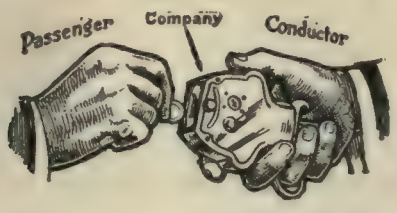
The Ohmer System not only furnishes accurate and complete records, but it also enforces honest service in the only practical way, *by making it worth while* for the conductors to be honest and efficient.

Give us an opportunity to tell you just what the Ohmer System really is. You will be interested because it deals with vital facts.

Ohmer Fare Register Company

Dayton, Ohio

The Portable Safe Deposit Vaults of the Industry



Rooke Fare Registers

In this day of the zone system, of fares deviating from the long standard five-cent fare, of fares ranging from two-and-one-half cents to twenty-five cents it is essential that some device be used by means of which these fares may be correctly tallied and the assurance given that *all* fares will be turned in.

The conductor should be, and is, if ROOKE registers are used, merely a means of operation in the collection system. When using the ROOKE register the conductor is the vault, which is a *safe* vault because of the accurate work of the ROOKE registers. The passenger *knows* that his fare is registered. The conductor *knows* how much he has collected at all times.

With a ROOKE register the passenger is the depositor, the register and your conductor the safe vault.

No matter what the fare may be; i. e., 5c., 10c., 25c. or paid in the form of a metal ticket, there is a ROOKE register with a capacity adequate to receive any combination of or *all* of these different coins and classify the values accurately, as—

—(1)—THE 2-COIN ROOKE FOR NICKELS and DIMES: The insertion of a nickel instantly moves up one point on the totalizing counter; the dime charges the conductor with two such points. The conductor's turn-in is figured at the rate of five-cents-a-point, for each numerical point accumulated on the *one totalizing counter.*

—(2)—THE 3-COIN ROOKE FOR NICKELS, DIMES and QUARTERS. The insertion of nickels and dimes charges the conductor exactly as with the two-coin type just described. The quarter operates another counter and charges the conductor on the 25c.-a-point-basis. This is a two-counter machine.

—(3)—THE 3-COIN ROOKE FOR NICKELS, DIMES and METAL TICKETS. This is a two-counter register. Nickles and dimes are registered on one counter and the metal ticket on an entirely separate counter. The metal coin can represent either a 2½c.—6c.—7c.—7½c.—8c.—9c. or any other arbitrary fare rate.

—(4)—THE 4-COIN ROOKE TO RECEIVE NICKELS, DIMES, QUARTERS and A 2½c. TICKET: This four-coin register would charge the conductor at the rate of *2½ cents for each point* accumulated on one totalizing counter for the *nickel, dime or ticket.* For instance, the insertion of the 2½c. metal ticket would operate one point on the totalizing counter; the insertion of a nickel, two points, and the dime, four points. The quarter would operate one point on an entirely separate counter.

All coins are deposited in the one slot and registration is automatic and instantaneous.

The ROOKE register is merely a portable, 23 ounce fare box which may be conveniently *brought to the passenger* when the passenger does not come to it.

Let us demonstrate

Rooke Automatic Register Co.
Providence, R. I.

3 to 10% Incre

Can You Use the Additional Revenue?

Ten years ago the Johnson Registering Fare Box was just getting its start. Today it is known everywhere. It is being used to the number of 23,000 in cities, large and small, from the Canadian border to the Gulf of Mexico and from New York to San Francisco. Successful railway operators are not content until installation of our boxes is complete on their properties.

What is the reason? The answer is that complete installation has proved a profitable investment because it brings increase of revenues without augmented traffic or higher rates of fare. It tends toward efficiency of service, greater cooperation from employees, faster schedules and a consequent better feeling on the part of the riding public.

The electric railway business in general is "looking upward." Reports from all parts of the country indicate that the serious crisis of the past few years is passing. Rates of fare are becoming stabilized on a new basis and as each Company finds that 6, 7, 8 or 10 cents is proving adequate, the up-to-date executives are applying modern methods which will assure the full benefits of these rates.

ase in Gross!

The following list gives the names of a few of the larger properties where executives have been convinced and have within the last month shown their conviction by ordering a sufficient number of our boxes to make their installations complete:

Eastern Massachusetts Street Ry. Co.
Connecticut Company
United Railways & Electric Co. of Baltimore
Capital Traction Co. (Washington, D. C.)
Washington Railway & Electric Co.
Memphis Street Railway Co.
Nashville Railway & Light Co.
San Antonio Public Service Co.
St. Joseph Railway Light, Heat & Power Co.
Twin City Rapid Transit Co.
Springfield Consol. Railway Co. (Springfield, Ill.)
San Francisco-Oakland Terminal Rys.
Michigan Railway Co.

The following companies have ordered our registering boxes as part equipment on new safety cars:

Boston Elevated Railway Co.
Brooklyn City Railroad Co.
Ottumwa Railway & Light Co.
Los Angeles Railway Corporation

Are you interested in a proposition which has resulted in a 3 to 10% increase in receipts on the above properties and scores of others? If so, act now.

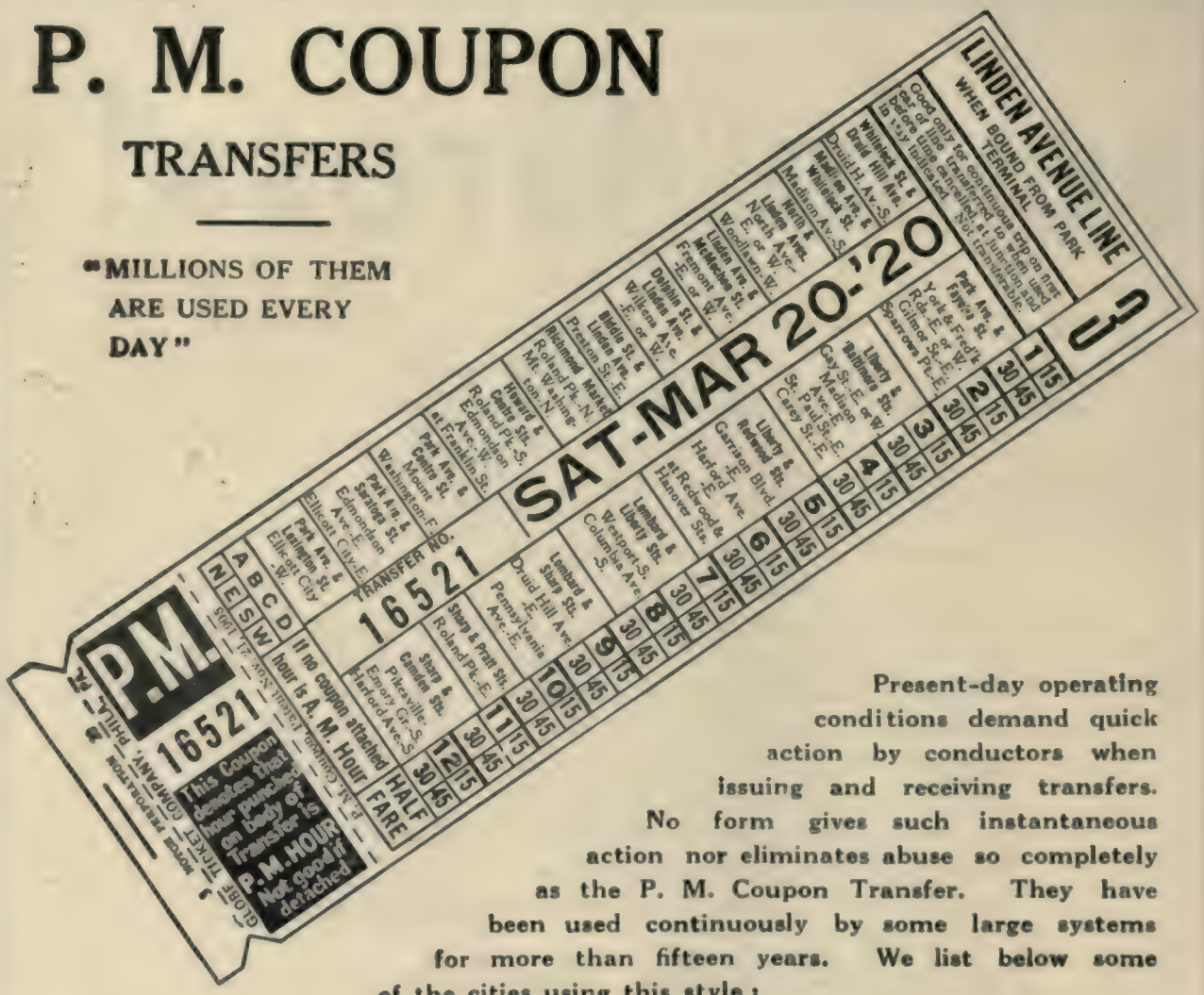
JOHNSON FARE BOX COMPANY

Jackson Boulevard and Robey Street, Chicago
50 East 42nd Street, New York

P. M. COUPON

TRANSFERS

"MILLIONS OF THEM ARE USED EVERY DAY"



Present-day operating conditions demand quick action by conductors when issuing and receiving transfers. No form gives such instantaneous action nor eliminates abuse so completely as the P. M. Coupon Transfer. They have been used continuously by some large systems for more than fifteen years. We list below some of the cities using this style:

Akron, Ohio
Albany, N. Y.
Altoona, Pa.
Anderson, Ind.
Baltimore, Md.
Binghampton, N. Y.
Bridgeport, Conn.
Brooklyn, N. Y.
Chattanooga, Tenn.
Columbus, Ohio
Dayton, Ohio
E. St. Louis Ills.
Elmira, N. Y.
For Worth, Tex.
Hartford, Conn.
Houston, Texas
Jersey City, N. J.
Lincoln, Neb.
Los Angeles, Cal.
Louisville, Ky.
Lynchburg, Va.
Memphis, Tenn.
Montgomery, Ala.
Newark, N. J.
New Haven, Conn.
New York City, N. Y.
Norfolk, Va.
Pittsburg, Pa.
Portland, Me.
Richmond, Va.
Roanoke, Va.
Saginaw, Mich.
San Diego, Cal.
Scranton, Pa.
Springfield, Ohio
St. Joseph, Mo.
Topeka, Kans.
Toledo, Ohio
Washington, D. C.
Wilkes-Barre, Pa.
York, Pa.
Youngstown, Pa.

WHEN PREPARING FOR THE SUMMER "RUSH" THIS FORM OF TRANSFER SHOULD BE GIVEN CAREFUL CONSIDERATION

GLOBE TICKET COMPANY

112-114 NORTH 12TH STREET

PHILADELPHIA, PA.



Bhang

is the particularly appropriate Indian name for the hemp plant from which the drug hashish is extracted.

Under its influence the influencee fades slowly away into inertness.

Our modern interpretation of Bhang is to blow up quickly while you have noted the Hindu's is to blow up slow-l-y—more on the order of the way a commutator blows up by misapplied carbon brushes. It spits and rattles and chatters and grooves and wears and finally just quits bhang.

If, at the first sympton a Morganite engineer had been called (from any of the subjoined addresses) he would have spotted the hashish brushes and supplanted them with Morganite.

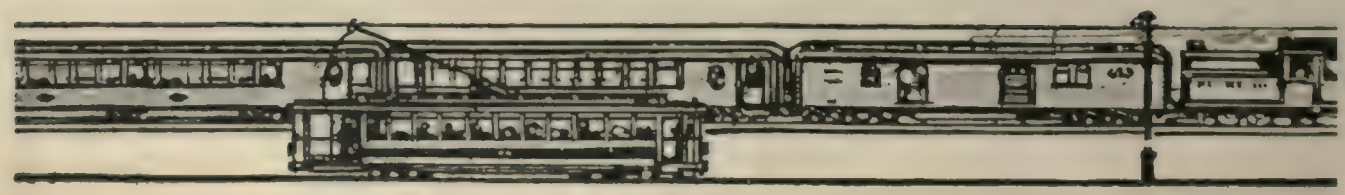
You can always bhank on

Morganite

The Morgan Crucible Company, Main Office and Factory: 519 West 38th St., New York

DISTRICT AGENTS:

Lewis & Roth, 13th and Wood Sts., Philadelphia
Electrical Engineering & Mfg. Co., First National Bank Bldg., Pittsburgh
W. L. Rose Equipment Co., La Salle Bldg., St. Louis
W. R. Hendrey Co., Hoge Bldg., Seattle
Herzog Electric & Engineering Co., 150 Steuart St., San Francisco.
Charles Farnham, I. W. Hellman Bldg., Los Angeles
Railway & Power Engineering Corporation, Ltd., 131 Eastern Ave., Toronto, Ontario, Canada.



Satisfactory Schedules

Schedules that can be adhered to are the only schedules that give satisfaction.

With the Pneumatic Door Engine you can eliminate all dead time, and unnecessary labor, both the result of hand operated doors.

The Pneumatic Door Engine comes with flexible or rigid driving arm for sliding doors and with latest improvement in driving connections for folding doors.

Not necessary to carry both right hand and left hand engines in stock, as the standard engine meets both requirements. Controlled by rods or levers (manual operation)—by magnetic valves and push buttons (electric operation)—by air push buttons (pneumatic operation).

The latter two operations, electric and air, are practically the same. In the former magnetic valves are operated by push buttons and in turn operate the valve on engine, while in the latter the magnetic valves are eliminated and the control is direct from air push buttons to valve on engine.

The air Push Button Control is particularly adapted to cars where operator is close to doors, and the electric control is desirable where operator is further removed from doors.

Why not send for particulars?



Air Push Button Control

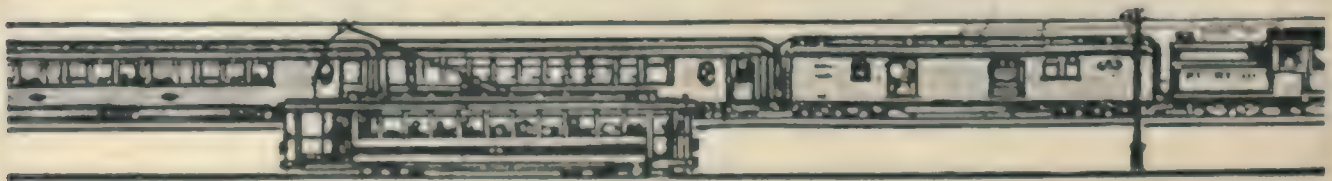


Standard Geared Type Door Engine

CONSOLIDATED CAR-HEATING COMPANY

Albany, New York

New York City **Chicago** **Coaticook, Quebec**



The Fabrikoid Process adds beauty and long life to fabrics; some heavy and rugged, others dainty as linen—all pliable, scuff-proof, stain-proof and water-proof

DU PONT FABRIKOID



A Strong Sanitary Seat Covering

WELL informed officials, when buying new equipment or when renewing upholstery, usually specify Fabrikoid.

They have learned that it wears splendidly, that it is washable and that it always retains its original beauty.

Fabrikoid upholstery does not absorb dust or germs. It is waterproof and stain-proof; it does not crack, scuff or grow shabby.

You cannot find a more practical seat covering, or one more thoroughly adapted to electric railway service. Samples will convince you.

DU PONT FABRIKOID CO.
WILMINGTON, DELAWARE

F A B R I K O I D



Car Space
Value is gauged
by Car Card Value

Collier Service

Maintains the Value of Both

Collier Service covers every nook and corner of the country so well that no matter how small or how large an advertiser is, service of the highest quality is rendered.

This means satisfied advertisers and it is only through the steady and uninterrupted support of satisfied advertisers that the stability of car space is maintained as a source of revenue to the railway company.

Barron G. Collier

Candler Building, New York

STANDS THE WEAR



Being made of extra quality stock smoothly braided

SAMSON SPOT TROLLEY CORD

gives long service. Being thoroughly water-proofed it resists the action of the weather. Know it by the Colored Spots, and don't overlook the fact that

SAMSON BELL AND REGISTER CORD

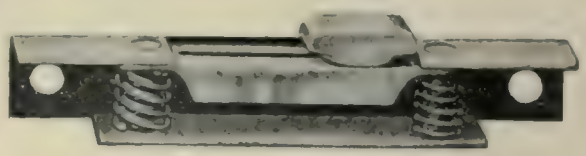
represents the same durability and economy.

All sizes, all colors

Samples and prices gladly sent

SAMSON CORDAGE WORKS, BOSTON, MASS.

WINDOW TROUBLES ARE ELIMINATED
with
EDWARDS COMPRESSION BRAKE DEVICE



Injuries caused by windows dropping on passengers' fingers result in claims against the Car Company.

Damage caused by windows dropping suddenly and cracking the sash frame, breaking the glass and damaging the sash lock, result in maintenance charges.

Both of these expenses may be cut by equipping your windows with Edwards Compression Brake Device which retards all downward movement.

The device may be fastened either to the sash or the edge of the stop casing next to the sash.

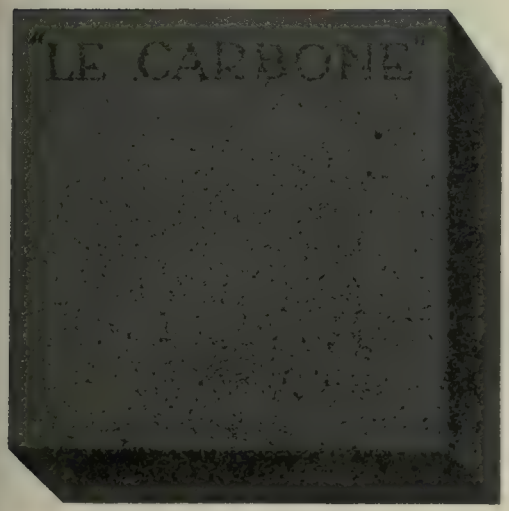
It has two springs of different tension, the heavier being at the top. When the sash is raised, the sliding shoe, pictured above, slides automatically to the bottom and compresses the weaker spring, allowing the sash to be raised with comparative ease. When the sash is lowered, the shoe automatically slides to the top and compresses the heavy spring. This increased pressure gives sufficient friction to prevent the sash from falling, and at the same time holds the sash firmly against the outer stops when the window is closed.

Edwards fixtures are standard on Birney Standard Safety Cars.

O. M. EDWARDS CO., INC., SYRACUSE, N. Y.

Manufacturer of:

Window Fixtures	Top, Bottom and Side	Metal Extension Platform	Metal Stop Casings
Sash Balances	Weather Stripping	Trap Doors	Railway Devices



Carbon Brushes

Uniform quality runs throughout the whole Le Carbone line of brushes. This assures the user of the same excellent results on his repeat orders.

You can reduce your brush and commutator maintenance to a minimum. A postcard will start you on the right track for lower maintenance.

W. J. JEANDRON

227 Fulton St., New York City

PITTSBURG OFFICE: 634 Wabash Bldg.

Canadian Distributors:

Lyman Tube & Supply Co., Ltd., Montreal and Toronto



Why Is a Safety Car Safe?

This question has often been asked. We answer it in this way:

The Safety Car is safe because it has all the known safety devices on it. It is under the control of one man who is in a position to see everything that is going on without paying attention to the inside of his car.

Everything should be made automatic as far as possible.

H. B. Life Guards are automatic, positive and instantaneous in action and minimize the front end accidents, which is an insurance against fatal accidents, and which Railway Operators cannot overlook. H. B. Life Guards are standard equipment on most safety cars, but make sure that you get them. Don't fail to specify H. B. Life Guards as manufactured by the Consolidated Car Fender Company.

Write for details

"Barrier of Safety" between the fallen pedestrian and the car wheels.



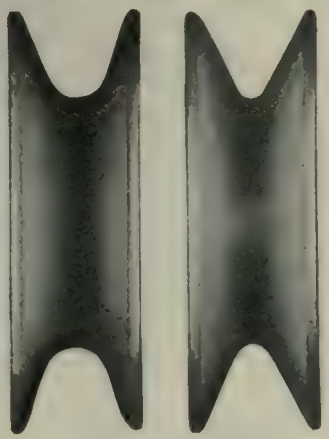
The Consolidated Car Fender Co.
Providence, R. I.

General Sales Agent

Wendell & MacDuffie Co.
61 Broadway, New York

Reduce Your Labor Costs

By Using Bayonet Trolley Equipment



"U" "V"

Kept in Better Condition with One-third the Time and Labor Required for the Old Style Riveted-to-the-Pole Type of Equipment

Bayonet Special Trolley Wheels

are made of the very highest grade of metal. No cheap alloys or old trolley wheels recast into new ones. All hand turned, insuring the greatest accuracy and balance. They are known all over the world for their superiority over other wheels, their economical and efficient service having been proved by competitive tests.



Bayonet Detachable Trolley Harps

are the only trolley harps with which you can change from wheel to sleet cutter or to a new wheel in TEN SECONDS. No tools required on top of the car; only your hand is necessary. All inspections, repairs, adjustments and lubricating are done at the work bench where they are better done. This eliminates unsatisfactory patchwork on top of car, insures perfect running trolleys and increases your trolley wheel mileage at least 33 1-3%.



Bayonet Trolley Base with Detachable Pole Clamp

is the only trolley base made on which the trolley pole can be changed in 30 SECONDS and the wheel be in perfect alignment with the wire, and no tools required to do the job. Greatest flexibility of pole action is afforded by long extension springs and self-lubricated bushings in bearings, and the roller bearing swivel gives freedom to the rotary motion. It is so constructed that you get a uniform wire pressure at all angles of pole. All wearing parts are quickly and cheaply renewed, making the main parts of the base everlasting.

Perfect conductivity is afforded by sliding contact between turret and base plate. It saves your overhead, your wheels and your wire by its freedom of action.



Bayonet Sleet Cutters

have no superiors in cutting ice from the wire. If the ice can be removed the Bayonet will do the job. We have the rigid and semi-rotary types (the kind you can back up with) both of which are detachable and interchangeable with the wheel. Only ten seconds necessary to make the change from harp with wheel to one with sleet cutter.

All Bayonet equipment sold subject to approval. You must be satisfied or your money will be refunded. Begin now to practise economy by using the Bayonet

BAYONET TROLLEY HARP CO.

Springfield, Ohio, U. S. A.



The Philadelphia Traction Company's
100 New Cars are Equipped with

Nevasplit Headlinings

NEVASPLIT is used on the 100 cars ordered through the Emergency Fleet Corporation for operation by the Philadelphia Rapid Transit Co. to the Hog Island Shipyards.

It pays to start right when buying new cars. Replacements are expensive.

Nevasplit Headlining reduces maintenance costs to the lowest degree. Once put up, it stays up without warping or splitting. It is waterproof, reduces the weight of the car and adds safety and beauty to the car interior.

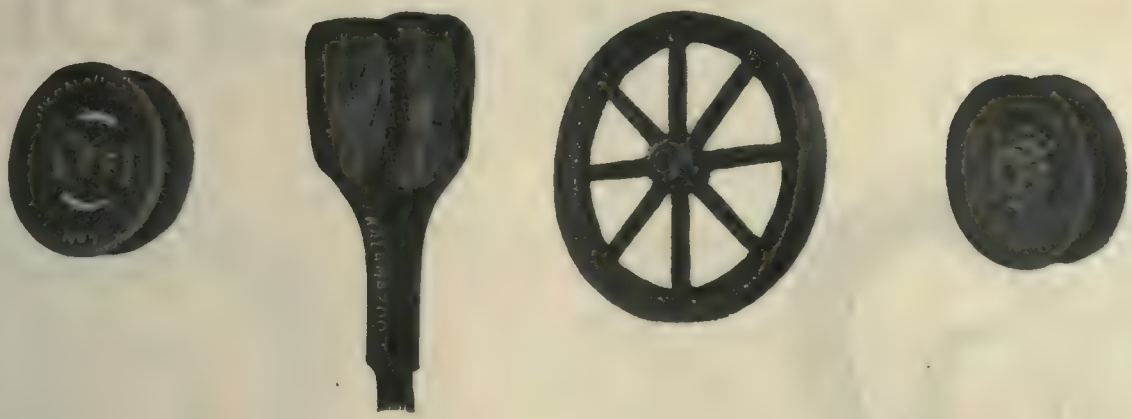
Write for booklet and samples of Nevasplit.

The Keyes Products Company

120 Broadway, New York

General Sales Agents: Columbia Machine Works and Malleable Iron Company, Brooklyn, N. Y.
National Safety Car & Equipment Co., St. Louis, Mo.

KALAMAZOO



Trolley Harps

Trolley Wheels

Kalamazoo Equipment has fully demonstrated the economy of quality. Long life under the hardest of service, even with conditions of wear more severe than could possibly be anticipated, has been proved by 20 years of performance on leading roads.

Kalamazoo wheels are made of virgin metal—pure lake copper—they are of proper design for the intended service, and are honestly manufactured.

They are perfectly balanced for easy running and freedom from slippage. They do not wear down and damage the wire, for wire life is more important than wheel life.

Kalamazoo Harps give perfect and continuous contact, and are designed to permit easy replacement of wheels.

Our Catalogue is a valuable handbook. Sent on request.

Star Brass Works
Kalamazoo, Michigan

MILLER TROLLEY SHOES



What They Stand For

1. Lower Maintenance Costs;

   They give greater mileage than ordinary contacts because of decreased tension on trolley base and because of sliding contact. They prevent arcing at spans and burning of trolley wire because of large contact. They do not come off the wire, hence no damaged car roofs, overhead or bent trolley poles.

2. The best that can be obtained for your high speed or city cars.

MILLER TROLLEY

West Newton

SPECIAL REPRESENTATIVE

EASTERN REPRESENTATIVE: National

SAL

Alfred Connor
Denver, Colo.

T. C. White & Co.
St. Louis, Mo.

F. F. Bodler
San Francisco, Calif.

GIVE YOUR MOTORS FULL TROLLEY VOLTAGE



What This Means To You

1. Preservation of Schedules:

   Your motorman is not constantly losing power and your motors get full voltage because of the large contact surface. Your conductor seldom has to get out and replace the pole on the wire, because Miller Shoes take a "bulldog grip" on the wire.

2. Increased Revenue:

   Lower maintenance costs mean more revenue. Passengers find they are not subjected to delays on cars equipped with Miller Shoes. Satisfied platform men are better salesmen of transportation.

SHOE COMPANY

Massachusetts

Holden & White, Inc., Chicago

Railway Appliance Co., New York

REPRESENTATIVES:

W. M. McClintock
St. Paul, Minn.

S. I. Wailes
Los Angeles, Calif.

W. F. McKenney
Portland, Oregon.

Eureka

Products Minimize Maintenance

EUREKA Controller Fingers are made of the best material obtainable, are drop-forged and hardened. They are interchangeable on all standard controllers.

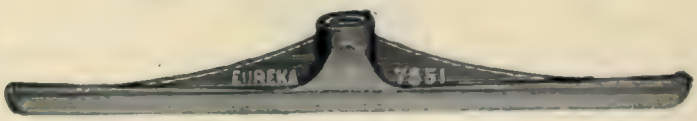


EUREKA Commutators are insulated with Canadian ambermica and fit any standard design of motor.

EUREKA Ears are cast in one piece. The central milling eliminates soldering.

EUREKA Trolley Wheels are made from toughest bronze obtainable. The perfect balance combined with the excellent wearing qualities of the metal insure long life and minimum wear on trolley wire.

All standard parts shipped from stock. Special parts made to order.



MANUFACTURED BY

THE EUREKA COMPANY

NORTH EAST, PENNSYLVANIA



Perfect
Lubrication
Guaranteed

with



Hensley Trolley Wheels

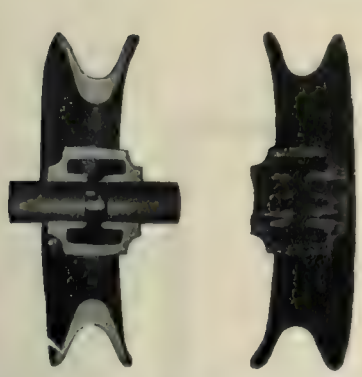
All Hensley Trolley Wheels have a grease-containing cavity from which the lubrication is fed to the hub of the wheel.

This cavity can be filled with one simple operation. It is not necessary to remove or uncap a spindle or remove a set-screw on the wheel. The end of the spindle is left open to take care of lubrication.

The fact that the wheel is always lubricated makes it exceedingly well suited for high speed Interurban Service as well as for the low speed city traffic service, and insures exceptionally long life.

Let us make you one of our satisfied customers.

A Catalogue for a Postcard



Hensley Trolley & Manufacturing Company

Detroit, Mich.

You'll find them nice people to do business with.

EARLL

Catchers and Retrievers



No. 10

FOR SAFETY
ORDINARY CITY
and
INTERURBAN CARS



No. 4A

Simplicity of design enables us to produce the lightest yet strongest Catchers and Retrievers.

Embodied in these Catchers and Retrievers are the features—the Ratchet Wind — Emergency Release — Drum Check—Free Winding Tension Spring and a number of others peculiar to Earll Catchers and Retrievers alone.

For the Safety Cars, we advise the use of Earll No. 10 Catchers or 4A-S Retrievers.

For Ordinary City Cars—Earll No. 7 or No. 10 Catchers, unless you want No. 4A-S Retrievers.

For Interurban Cars—Earll No. 4A-L or 5A-L Retrievers will prove satisfactory.

We have devoted years of experience to perfecting Catchers and Retrievers to satisfy your conditions.

No. 5A

Let us send you samples.



C. I. EARLL, YORK, PA.

No. 7





Longer Trolley Wheel Mileage

NOT even the best trolley wheel can function properly for any length of time if equipped with a poor bushing—and that means any type of plain bushing.

Any bushing that is unable to deliver a long period of good service without frequent attention for lubrication is going to prove a costly investment—no matter how low its first cost. Maintenance, replacements, low voltage: no end of trouble.

Bound Brook (Oil-less) Trolley Wheel Bushings require less attention. It is seldom that a Bound Brook Bushing fails to outlast the wheel itself. *When it's time to replace a Bound Brook, it's time to replace the wheel.*

The record of Bound Brook Oil-less Bushings—in service on over 60% of the country's electric systems—shows that they outlast by a wide margin all other bushings of whatever make.

All Genuine Graphited Oil-less Bushings have always been made at Bound Brook, U. S. A.

Bound Brook Oil-less Bearing Company

Specialists in the manufacture of Oil-less Bushings for more than a third of a century.

Bound Brook, New Jersey

Detroit Office, 1723 Ford Bldg.


BANK
Maintenanc
V-K Non-A
Harp.
V-K Oilless
Trolley Wheel
The V-K

costs can be reduced

POORLY designed and constructed trolley wheels are bound to increase the expense of overhead maintenance. If you use wheels that are considered "good" but that are lacking in some one of the qualities of design or material that insure proper balance, even wear and maximum conductivity, your costs will still be too high. Not until you install wheels that combine *all* the essential features of the highest type of design, material and workmanship will your cost curve show a gratifying downward trend.

V-K Oilless Trolley Wheels unquestionably belong to the latter—the expense reducing class.

They are made of special metal, perfect in texture, tough—yet not too hard. They're durable—properly balanced. Their conductivity is unusually high.

The patented graphite and gauze bushing, which is heat proof and almost indestructible, insures constant and lasting lubrication. There is no grease or oil around the bearing to interfere with the free flow of the current thru the V-K Wheel.

This Wheel, used with the V-K Non-Arcing Harp, provides the best form of contact yet invented. It enables the current from the wheel to be taken right thru the bearing without loss or interruption from arcing. The contact springs, while they serve to facilitate the flow of current, also act as cushions to prevent excessive shocks and dewirements of the wheel.

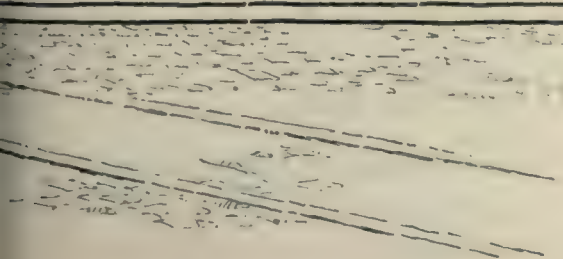
The distinctive and patented feature of this harp is the V-K gripping device. By means of this, the axle pin is firmly held and locked, thus preventing arcing which is the inevitable result of operating with loose or badly fitting pins.

We solicit correspondence from executives in charge of operation and maintenance. Catalogs covering our complete line will be sent free on request.

More-Jones Brass & Metal Co.

St. Louis, Missouri

Oilless Trolley Wheel and Non-Arcing Harp



Chillingworth One-Piece Gear Cases



Latest Improved Design of Two Point End Suspended Case

Chillingworth Gear Cases are made from deep drawing open hearth steel:

Seamless—Protecting your gears and pinions from water, mud or dirt, and preventing oil leakage.

Rivetless—Making them immune to loosening from vibration.

Light Weight—40% lighter than malleable iron cases and more durable, since on bad roadbeds, where a malleable iron case would smash, a Chillingworth merely dents.

Fitted with Chillingworth Malleable Iron Brackets that hold them securely to the motor frame. Especially designed to withstand vibration and ordinary rubbing over obstacles in the roadbed.

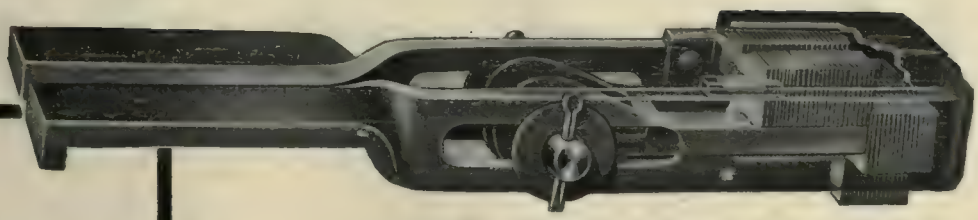


Typical Side Suspended Cases



THAYER & COMPANY, Inc.

111 Broadway, New York City



SAFE BRAKING

Safe braking means that your brakes are safe *all* the time.

To be safe the slack which comes from wear on the brake shoes must be taken up and taken up when necessary.

With our slack adjusters, there is no liability of human error, inasmuch as the adjuster takes care of the slack automatically.

Accidents, with the usual excuse, "The brakes wouldn't work," are dreaded by the operator. Stop these accidents, by stopping the excuse, with Smith-Ward Brake Slack Adjusters.

The number of cars now in operaton equipped with these slack adjusters prove our contention that they are satisfactory and 100% efficient.

SMITH-WARD BRAKE CO., BROOKLYN, NEW YORK

Boyerized

To More Safety



Safety First, did you say?

Why, that's an old story with us!

Long before that phrase became common we were preaching the gospel of attaining Safety First through the elimination of soft brake pins and bushings by

Boyerized
Safety Pins and Bushings

Where did we do the preaching?

Right down in the shop, to those men who were only too well acquainted with the high accident and high upkeep costs of the pins and bushings that were then common on both new cars and old.

We didn't ask them to take our word for our claims. Just requested them to try a few samples and see for themselves.

And it was because these *practical* men were "shown" so well, that Boyerized Pins and Bushings are now sold by the hundred thousand to give

Greatest Safety and
Longest Life

Other Boyerized Prod

Boyerized Nuts and B
Manganese Brake Hea
Manganese Body Bush

Bemis Car Truck Co.,

Brake Aids

At Less Expense

Safety Cars, did you ask?

Sure! On hundreds and hundreds of them!

Boyerized Pins and Bushings proved good on the old-style cars, but they're all the better for the faster-braking Safety Car equipped with air brakes, because

Harder Service Demands Higher Protection

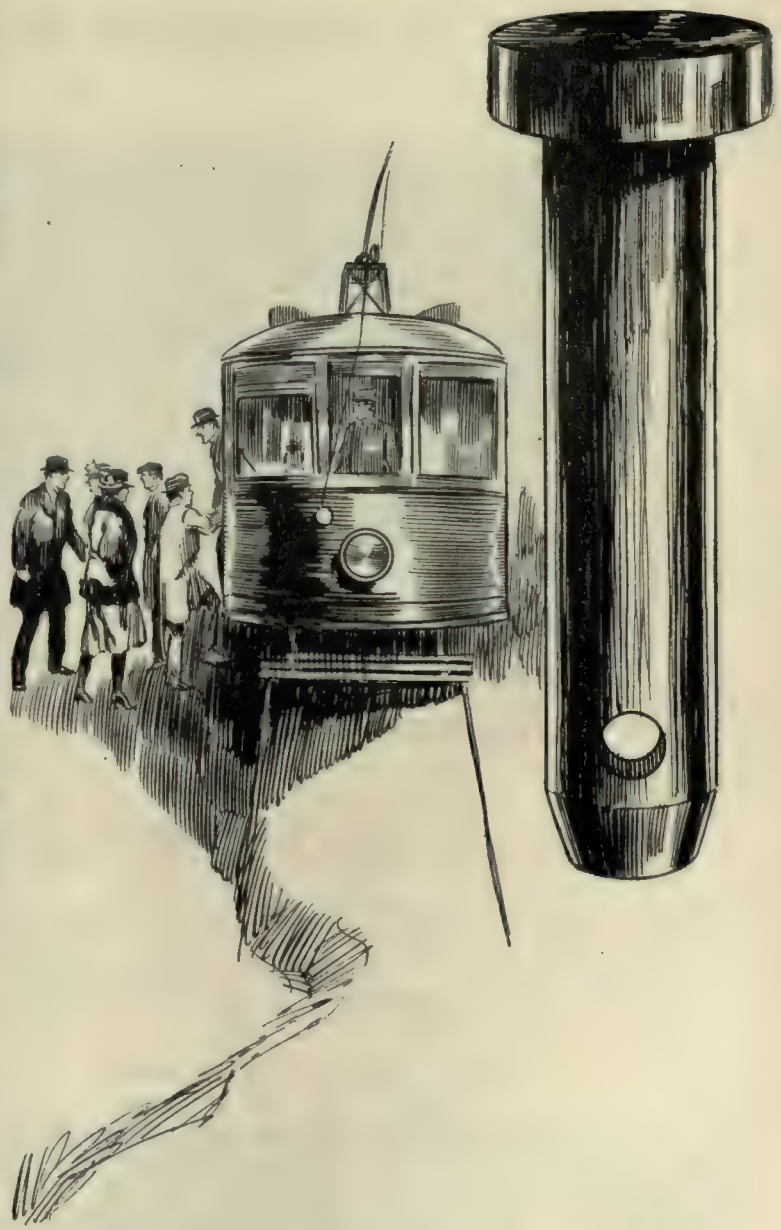
What has Safety Car service to do with better brake pins and bushings?

Lots! Because the Safety Car is so light, say 450 lb. to the seat, that the variations in braking load are much greater than in cars weighing 900 to 1400 lb. per seat. The live load may actually equal the dead load.

The corresponding range in braking applications naturally calls for the highest possible grade of brake pins and bushings.

Of course, "highest grade" means Boyerized Pins and Bushings, and only Boyerized; on the bases of proved strength, dependable uniformity and

Lowest Cost per 100,000 Car-Miles



at Reduce Maintenance

mis Trucks
nganese Transom Plates
onze Axle Bearings

Springfield, Mass.

Maintenance by Elimination of Maintenance—

HOW ONE ELECTRIC RAILWAY DOES IT
WITH "TOOL STEEL" QUALITY

LETTER from customer dated September 1st, 1916:

> "Ship us some Tool Steel pinions for baby motor equipment. Original pinions, high grade quenched type, wore out in 15,000 miles, the second lot wore out in 12,500 miles."

LETTER from same customer dated September 12th, 1919:

> "Send us some more Tool Steel pinions. The original ones which you furnished for this equipment gave about 115,000 miles."

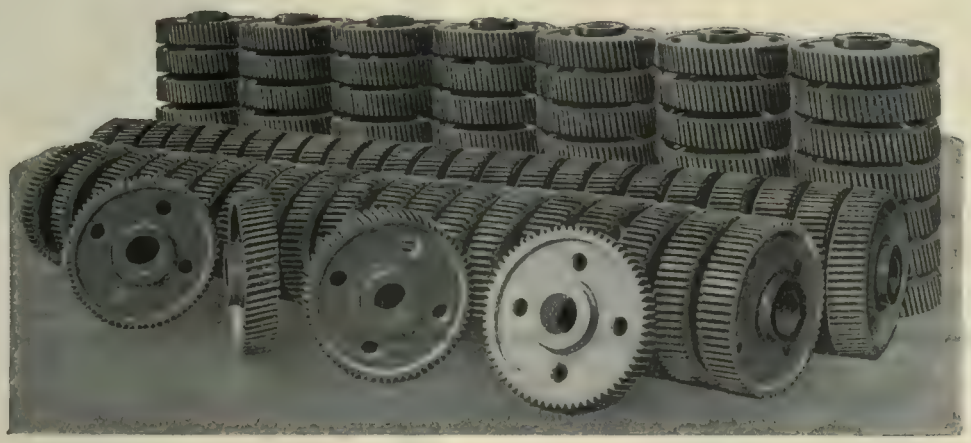
This is not a comparison with soft pinions, but with the high-grade, widely advertised, high-priced variety.

Watch your gears on "Safety Cars" & "Baby motors". The superiority of Tool Steel hardening is more pronounced on the fine teeth than on coarser pitches.

The Tool Steel Gear & Pinion Co. Cincinnati, O.

5458 Helical Gears
5596 Helical Pinions

Ordered in
Five Months



MEMBER OF AGMA

The Railway men of the country were introduced to the latest development in Railway gearing at the AERA Convention last October.

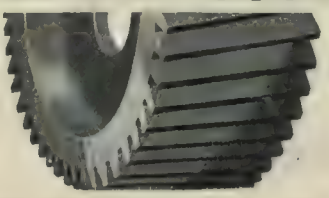
Those new Helical gears looked good. Their principle of operation was right. The gear was an evolution in railway gearing practices, and the mechanical men saw it. They saw, too, that railway operation could be raised to a new plane and this is being done rapidly.

To date, 5,458 Helical gears and 5,596 Helical pinions have been sold to Electric Railway Companies, and the silent and powerful Helical gears are doing everything expected of them.

R. D. NUTTALL CO.
Pittsburgh, Pa.

Nuttall Helical Gears

A PROVEN SUCCESS



Rollway Bearings

Lubrication

They are practically frictionless and of unquestioned durability. They require lubrication not oftener than four times a year.

Adaptability

They can be adapted to existing types of railway trucks and axles. No better bearings made for the safety car.

Adjustment

They require no adjustment to be made in assembling the bearing on the axle, and do not require a skilled mechanic to do the work.

Price

Low enough to warrant universal adoption and standardization.

Rollway Bearings are oil-tight and dust-proof. They have proven capable of carrying the heaviest loads and maintaining the highest speeds required in the Electric Railway Service.

Send for Details



The Railway Roller Bearing Co.

Syracuse, N. Y.

Auxiliary Controlled Circuits

The "Exide" Battery is used by a number of railways as a source of current at low voltage for operating auxiliaries, by contractors, and for multiple unit and similar control circuits.

Standby Service for Exciter Bus

It is standard practice to install a storage battery connected to the Exciter Bus to prevent interruption in the supply of current for field excitation. The "Exide" Battery is used for this service.

Oil Switch Service

Storage batteries are used in power houses and sub-stations for the operation of oil switches and for supplying current for pilot lamps and emergency station lights in case of failure of power supply. For this service the "Chloride-Accumulator" and the "Exide" battery are used.













"Exide"
"Chloride Accumulator"
"Ironclad-Exide"
Batteries

For every service in Railway Electrification

Head and Tail Lights

The "Exide" Battery is being used in connection with head lights and tail lights for furnishing current in case of interruptions in power supply.

Load Regulation

For carrying peaks and fluctuations of load, especially in connection with water power developments or where power is purchased on the basis of maximum demand, or for line voltage regulation, the "Chloride-Accumulator" is adapted.

High-Voltage, Direct-Current Locomotives

Direct current for operating compressor motors and auxiliary control apparatus during interruption of the normal power supply is important. The "Ironclad-Exide" Battery has been furnished for a number of large electric locomotives of this type.

Storage Battery Locomotives

In Yards and on Sidings where overhead wires or third rail construction are objectionable, a storage battery locomotive equipped with the "Ironclad-Exide" Battery will meet the requirements.

Regeneration on Mountain Grades

As a reservoir for storing the energy developed by regeneration while descending a long mountain grade, a storage battery of "Chloride Accumulator" "will fill the bill."

THE ELECTRIC STORAGE BATTERY CO.

Manufacturer of

The "Chloride-Accumulator" The "Tudor Accumulator"

The "Exide" "Hycap-Exide" "Thin-Exide" The "Ironclad-Exide" Batteries

New York Boston Chicago Washington Cleveland Atlanta Pittsburgh Minneapolis

PHILADELPHIA, PA. 1888-1920

Rochester Detroit St. Louis Kansas City Denver San Francisco

Special Canadian Representative: Chas. E. Goad Engineering Co., Toronto and Montreal

-an individual lubricating Servic



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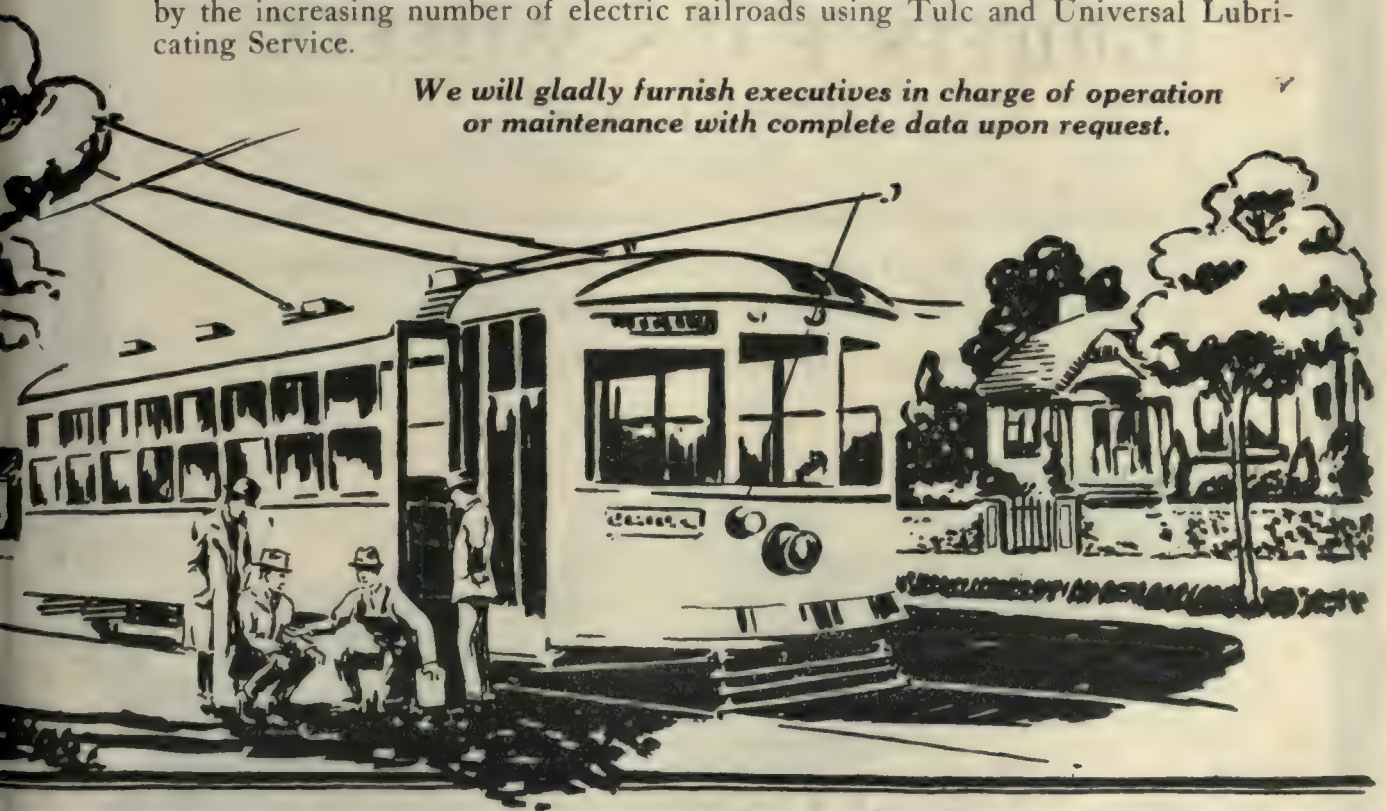
hat helps reduce maintenance costs

THIS is what we mean by "Individual Lubricating Service." In the first place, your property is considered as an individual unit, presumably requiring a lubricant and a service different from that needed by other properties.

With this thought in mind, our service men made a thorough analysis of your requirements from the viewpoint of the lubricating specialist, checking carefully the physical characteristics of your property, type and condition of equipment, nature of service to the public, etc. Then, and not before, tests and demonstrations of the lubricant which they believe to be the best for your *individual requirements* are made. These tests are carried out over an extended period, giving you ample opportunity to check results and determine their value from the money saving standpoint.

That these scientific investigations *do* result in reduced operating costs is evidenced by the increasing number of electric railroads using Tulc and Universal Lubricating Service.

We will gladly furnish executives in charge of operation or maintenance with complete data upon request.



NIVERSAL LUBRICATING CO

CLEVELAND OHIO



F.C.S. Wheels

have the Right Material in the Right Place

The surface of tread and flange contains three and one-half per cent carbon white iron, harder than tool steel, insuring long wear.

The softer hub permits easy machining.

The arched face plate gives additional strength.

Reasons why you should use GRIFFIN F. C. S. WHEELS

Less wearing away of metal of the flange.

Less chance for derailment at switch points and on curved worn rail because of freedom from sharp flanges.

Less wearing away of metal at the gauge of rail because the rubbing friction is at a minimum.

Less resistance to movement of the car.

Less resistance on curves.

Less power required for traction.

Less metal worn away from brake shoe per unit of work.

Less reduction in diameter per unit of service, therefore less labor in removing wheels to maintain the same diameter of wheel throughout the same car.



Griffin Wheel Company

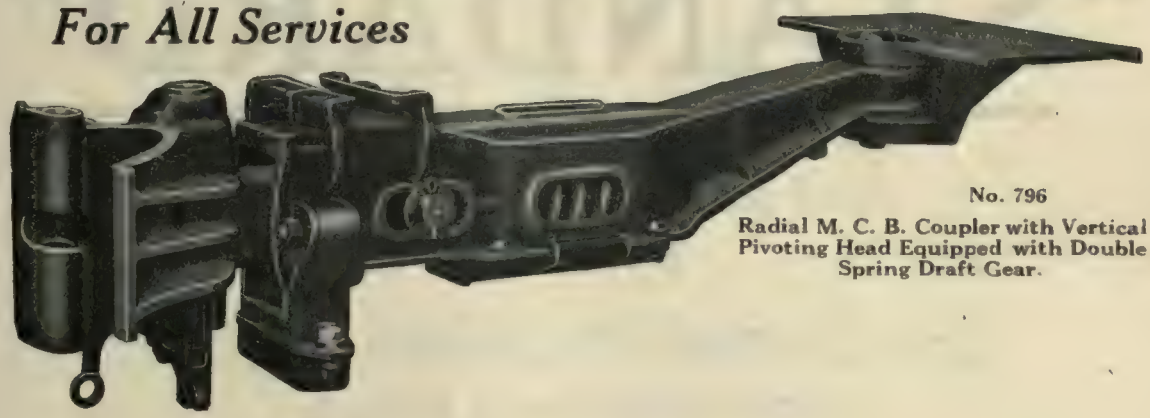
McCormick Building, Chicago, Ill.

FOUNDRIES:

Chicago Detroit St. Paul Boston Tacoma Los Angeles Kansas City Denver

VAN DORN COUPLERS

For All Services



No. 796
Radial M. C. B. Coupler with Vertical Pivoting Head Equipped with Double Spring Draft Gear.

All Van Dorn Couplers couple automatically by impact. Coupling is positive and certain, even when couplers are greatly out of line horizontally or vertically, or both.

Vertical Pivoting Head relieves platform strains at sharp changes in grade.

Radial movement 120°. Radial Carrier eliminates binding. Van Dorn M. C. B. Couplers interchange with all standard M. C. B. couplers on both steam and electric railroads.

For Heavy City and Medium heavy Interurban Service.



No. 1200
Car-and-Air Couplers equipped with No. 1160 Draft Gear.

WRITE FOR CATALOG!

VAN DORN COUPLER COMPANY

2325 South Paulina St., Chicago, Ill.

"STANDARD"

Steel Tires

Steel Tired Wheels

Solid Rolled Steel Wheels

O. H. Steel and Malleable Iron Castings

Solid Forged Gear Blanks

Steel Forgings Iron Forgings

Forged and Rolled Steel

Pipe Flanges

Ring Dies

Rings

Roll Shells Steel Springs



"The 'Standard' Brand on your material is an assurance of eventual economy."



STANDARD STEEL WORKS CO.

GENERAL OFFICES:

500 NORTH BROAD ST., PHILADELPHIA, PA.

CHICAGO
ST. LOUIS
HAVANA, CUBA

RICHMOND
SAN FRANCISCO
NEW YORK
MONTEREY, MEX.

MEXICO CITY
LONDON, ENGLAND
PARIS, FRANCE

AXLES

for street, subway, elevated and interurban cars.

Annealed.

Coffin treated.

Quenched and tempered.

Heat treated to other specifications (if satisfactory).

MIDVALE STEEL AND ORDNANCE COMPANY
CAMBRIA STEEL COMPANY

General Sales Office, WIDENER BUILDING, PHILADELPHIA, PA.

District Sales Offices:

Atlanta Boston Chicago Cincinnati Cleveland Detroit New York Philadelphia Pittsburgh
San Francisco Salt Lake City Seattle St. Louis

Sole Export Representative:
CONSOLIDATED STEEL CORPORATION, 165 Broadway, New York
All export inquiries should be sent to this address.

27-I

TAYLOR R. H. REDUCED HEIGHT TRUCKS

Insure Easy Riding Cars and Low Maintenance



WHEEL BASE 5 ft. 2 in.

Mounted on 26-Inch Wheels With Springs Over Journal Boxes
Designed to Mount Centre and End Entrance Cars Low Down

SWING MOTION AND FULL ELLIPTIC SPRINGS
MOTORS AND BRAKES INSIDE HUNG
WEIGHT OF CAR BODIES 16,000 TO 22,000 LBS.
HEIGHT FROM RAIL TO CAR BODY BOLSTER 22¾ IN.

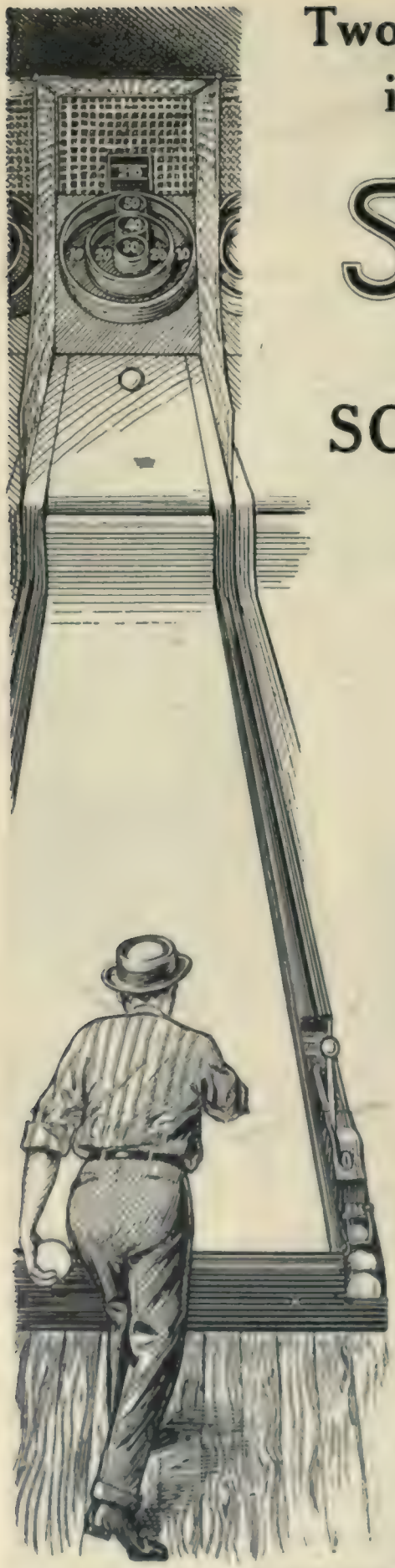
The Public Wants the Low-Level Car —and Speed—and SAFETY!



TAYLOR ELECTRIC TRUCK COMPANY

SEND FOR PORTFOLIO TROY, N. Y. *ESTABLISHED* 1892


WASHINGTON
OREGON
MONTANA
IDAHO
WYOMING
NEVADA
UTAH
COLORADO
CALIFORNIA
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MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
S.CAROLINA
N.CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE
DOMINION OF CANADA
NOVA SCOTIA
49
The map above shows the location of the 49 foundries in the United States and Canada represented by the Association of Manufacturers of Chilled Car Wheels.
Chicago 3
St Louis 2
Buffalo 4
Pittsburg 2
Cleveland 2
Amherst N.S.
Montreal
Mich. City. Ind.
Louisville.
Mt. Vernon Ill.
Ft Wayne. Ind
Birmingham
Atlanta.
Savannah
Boston
Detroit
St. Paul.
Kansas City. Kan
Denver
Tacoma
Los Angeles
Rochester N.Y.
Sayre. Pa.
Lime Rock. Conn
Albany.
Toronto.
New Glasgow N.S.
Madison. Ill
Berwick Pa
Huntingdon. W.Va.
Wilmington Del
Houston Tex
Hannibal Mo
Reading Pa
Baltimore
Richmond Va.
Ft William Ont.
St Thomas "
Hamilton "
Ramapo. N.Y.
Marshall. Tex
Capacity
20,000
CHILLED
IRON WHEELS
Per Day
25 Million in Service
Association of Manufacturers
of Chilled Car Wheels
1220 McCormick Bldg. Chicago.



Two of the Biggest Money Makers in Trolley Parks Today Are

SKEE BALL ALLEYS

and

SCORE BALL TABLES

SKEE BALL is known from coast to coast. It is one of the few amusements that appeal to men, women and children. Unlike most other park games, its popularity increases.

The Philadelphia Rapid Transit Company have had ten alleys in active operation at Willow Grove Park for three years. Receipts last season were larger than ever.

SCORE BALL, for a small investment, is the *biggest money maker* of its kind on the market. These games will earn their cost within a few days.

Our latest models of both games are very much improved.

Send for Catalogue.

Order without delay for early Spring delivery.

Manufacturers and Distributors

Skee Ball Company

1015 North Bodine Street
Philadelphia, Penna.



Unaffected by Service Conditions

The crossover points are your weakest wire points. They can be made the strongest by using Anderson Crossovers, which are equipped with approach cars of bronze so pivoted to the main casting that they rise slightly with the approach of the trolley wheel diminishing the wear, and preventing crystallization, the forerunner of breakage.

These cars are removable and replaceable in a way that will not disturb the body of the crossing.

Catalogue 8 telling all about it is ready for you now

ALBERT & J. M. ANDERSON MFG. CO.

(Established 1877)

289-293 A Street, Boston, Mass., U. S. A.

BRANCHES:

New York, 135 Broadway
Chicago: 105 So. Dearborn Street
Philadelphia, 429 Real Estate Trust Bldg.
London, E. C., 48 Milton Street

ROEBLING ELECTRICAL

We make with strict attention to quality of materials and workmanship:

Trolley Wire
Wire Strand
Welding Wire
Weatherproof Wire
Car Wire and Strand

Power Cables Rubber Covered
Paper Covered
Cambric Covered

WIRES AND CABLES

John A. Roebling's Sons Co.
Trenton, N. J.

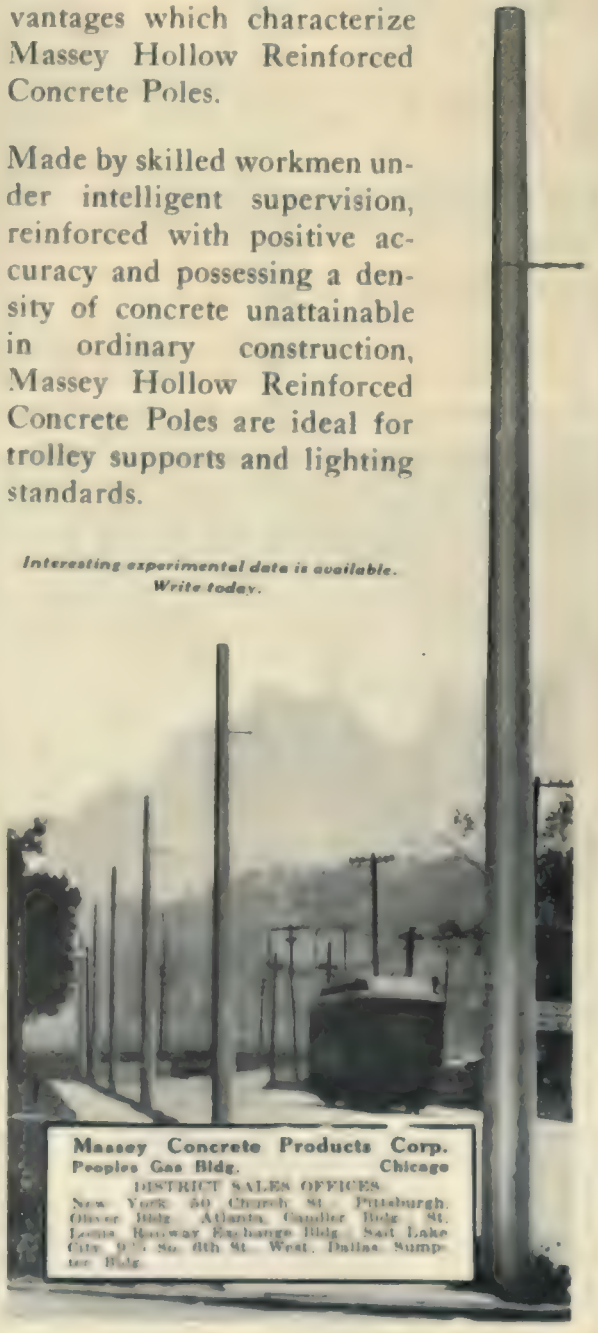
Branches:
New York Boston Chicago Philadelphia Pittsburgh
Cleveland Atlanta San Francisco Los Angeles
Seattle Portland, Ore.

Permanent!

Immune to fire, lightning or electrolytic corrosion; durable as solid concrete—but of hollow construction, allowing utmost ease in handling; low in first cost and with negligible upkeep expense—these are a few of the decided advantages which characterize Massey Hollow Reinforced Concrete Poles.

Made by skilled workmen under intelligent supervision, reinforced with positive accuracy and possessing a density of concrete unattainable in ordinary construction, Massey Hollow Reinforced Concrete Poles are ideal for trolley supports and lighting standards.

Interesting experimental data is available. Write today.



Massey Concrete Products Corp.
Peoples Gas Bldg. Chicago
DISTRICT SALES OFFICES
New York 50 Church St. Pittsburgh, Oliver Bldg. Atlanta, Candler Bldg. St. Louis Railway Exchange Bldg. Salt Lake City 9[illegible] So. 4th St. West. Dallas Sumpter Bldg.

CYPRESS

"The Wood Eternal"

gives insurance against a continuous big *labor cost* for renewals and replacements in the many railway uses for lumber.

When you specify and use

All Heart Cypress for Ties, Fencing, Trunking and Capping, Cross Arms, &c

you know it will give longer service than any other material. You know, too, how labor costs exceed material costs in almost every case. Of course even Cypress may eventually have to be replaced. Nothing lasts quite "forever." But in the long service-life you get from all-heart Cypress you will have *saved* a lot of labor costs in *maintenance alone.*

Anyway, that's why a number of the biggest railways in the country *insist* on All-Heart Cypress.

S C M A

TRADE MARK REG. U.S. PAT. OFFICE

"*Buy by the Cypress Arrow.*" Look for this mark on the end of every piece—or on every bundle. Our data is at your service.

Southern Cypress Mfrs.' Association
1265 Hibernia Bank Building, New Orleans, La., or
1265 Heard National Bank Bldg., Jacksonville, Fla.



Rome

COPPER AND BRONZE BARE WIRE
Round, square and rectangular, plain and tinned.

HOT ROLLED COPPER AND BRONZE RODS

COPPER AND BRONZE TROLLEY WIRES
Round, grooved and figure eight

POWER CABLES
Solid and stranded.

ROUND EDGE FLAT COPPER WIRE

MAGNET WIRE
Round square and rectangular cotton covered, silk covered, enamel covered, enamel and cotton, enamel and silk.

POLISHED COPPER PIANO COVERING WIRE



Wire

WIRES AND CABLES FOR EXPORT

GATHERING LOCOMOTIVE CABLE

MINING MACHINE CABLE

DECK CABLE

BREWERY CORD

SPECIAL WIRES AND CABLES

GAS ENGINE CABLE

RUBBER INSULATED WIRE
Bridle wires, flexible cords, jumper wires, telephone wires, N. E. C. S. wire, fixture wires, heater cords.

AUTOMOBILE WIRES
Charging cables, ignition wires, starter cable, lighting wire, horn wire.



—here's a wire pulling clamp that's *different*

—different in this way. It's of large capacity but light in weight. It can be quickly put on and quickly removed. It can be readily shoved out and pulled in on the wire. It will take hold of a wire, either bare or insulated copper or aluminum without biting it. And its construction is such that it cannot accidently drop off.

Do you know of any other clamp that combines all these features? Electrical engineers everywhere find Bush Wire Pulling Clamps an indispensable part of their equipment.

Bulletin "A" describes and illustrates a number of Bush Electric Safety Tools. It's a booklet that should be on your desk for ready reference.

Write today for a copy.

BUSH Wire Pulling Clamps

The Bush Electric Co.
Cleveland, Ohio

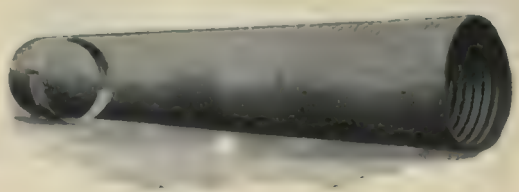
A Real Money Saving on Corrugated Metal Culverts

We have saved many culvert users a nice bunch of money on their culvert contracts. We can do the same for you. Some of these buyers have frankly told us that they had almost neglected to consider us in mailing out their requests for prices. Some had been erroneously informed that we did not make anything but the Nestable Culvert while others had been persuaded to think that our extreme distance from ultimate destination made it impossible for us to be in the running.

Now in the first place, we make both the Nestable and Round Riveted Culvert and can therefore furnish whichever you prefer.



"ACME" (Nestable)



"IMPERIAL" Riveted

As to distance, we have in mind a recent order from a customer in Utah for approximately 3400 feet of Imperial Riveted Steel Culverts for use on a Federal Aid contract and another customer in West Virginia who gave us an order for 6000 feet of "ACMES" assorted sizes, nested, for State Highway Work.

It required two gondolas to ship the 3400 feet of Riveted pipe to Utah and only *one* box car to ship that 6000 feet of "ACME" pipe, nested, to West Virginia. That is one big point in favor of Nestable —reduced freight charges. However, in both these cases we saved the customers money, which saving they would have lost entirely if they had not gotten our prices.

When you are in the market be sure and write us so that we may present our money saving proposition to you. And remember—we will be glad at any time to give you our advice regarding the respective merits of Nestable and Riveted Pipe, as we make both kinds and therefore can speak impartially.

THE CANTON CULVERT & SILO CO.
MANUFACTURERS
CANTON, OHIO, U.S.A.

It does not just happen that the "CHEATHAM SWITCH" is used by nearly every important Street Railway. It is wonderfully rugged. Simple in construction. Low cost of maintenance. Labor and time saver. And the Cheatham Electric Switching Device Co., of Louisville, gives real service.

Westinghouse—Frankel Solderless Connectors

W WESTINGHOUSE ELECTRIC

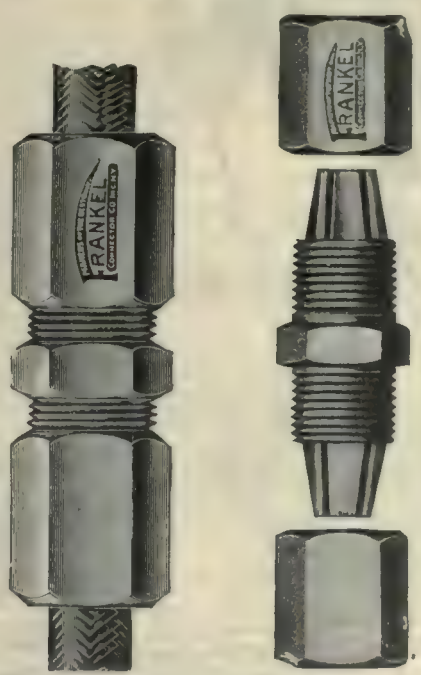
At the Critical Moment

What does it cost when that overheated soldered connection fails and your service is interrupted until a tedious repair has been made?

Higher wages and shorter hours make time more valuable than ever, and unnecessary delays must be avoided. Frankel Solderless Connectors are the logical solution. Frankel connectors stand maximum overload without injury, are quickly installed and removed by even the inexperienced, eliminate solder and the blow torch and are adapted to all sorts of splicing.

In short — Frankel Solderless Connectors make perfect splices with real economy.

Send for Miniature Catalogue I-B 3



MAKERS OF THE BEST ONLY FRANKEL CONNECTOR CO. INC. N.Y.

Westinghouse Electric and Manufacturing Co.
East Pittsburgh, Pa.
Sole Agent in the United States

VAC-M



Your equipment can have no better insurance against damage by lightning than a VAC-M Arrester.

The wide gap of the VAC-M and consequent freedom from grounds insure continuity of service.

A line protected by a VAC-M with a 200-v. ½-ampere fuse was crossed with a 6600-volt electric light circuit with no damage resulting to the equipment back of the arrester.

Let us prove it

The National Electric Specialty Co.
Terminal Bldg., Toledo, Ohio

A CLEAN SWEEP
with
Paxson Brooms



No. 1. Flat Wire to sweep crossings.

No. 2. For switches, frogs, etc., to remove snow and light dirt.

No. 3. Flat Wire for slush, mud and dirt, in curves and switches.

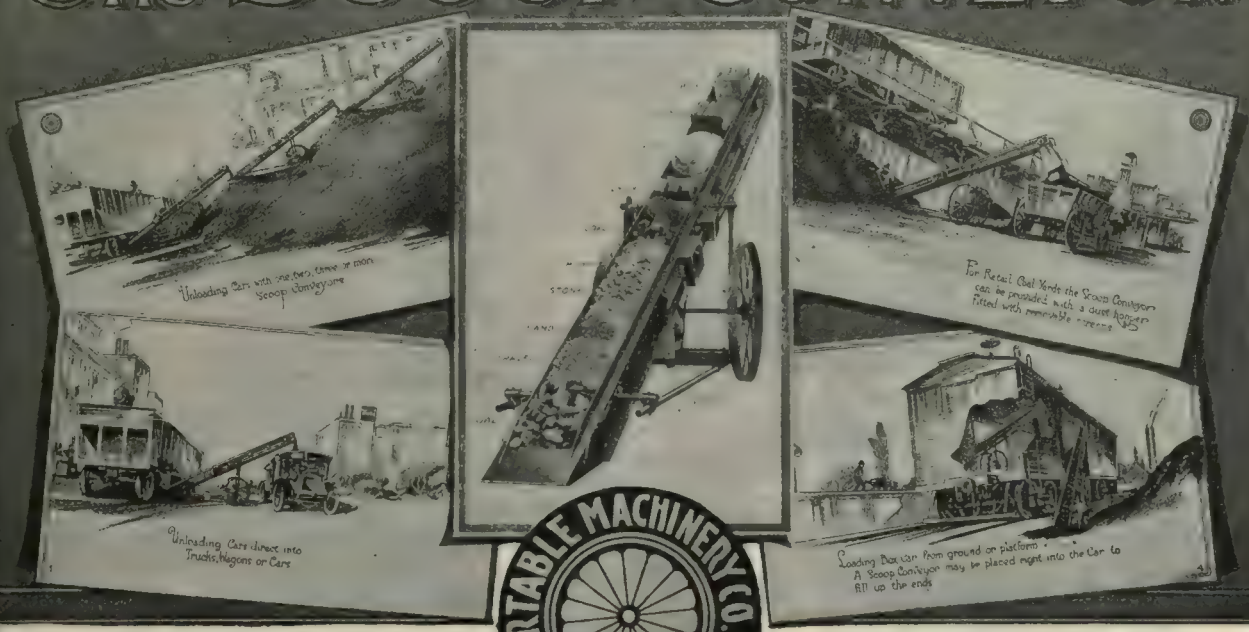
Supplied with chisel on end of handle for ice or other obstructions, also to throw switches.



Send for details.

J.W. Paxson Co.
1021 N. Delaware Ave.
Philadelphia, Pa.

The SCOOP CONVEYOR



Does 6 to 12 Men's Work

In storing and reclaiming, in loading and unloading cars, trucks and wagons. It keeps trucks and other equipment moving. Enables men to work faster and easier. Saves car demurrage.

Over 2000 Users

The Scoop Conveyor has been adopted by over 2000 leading American manufacturers, contractors and coal dealers.

Write for Catalogue No. 57

PORTABLE MACHINERY CO., Passaic, N. J.

Mr. Power House Engineer:—

Watch Your Field Coils!

The temperatures of your field coils are given instantly by the VAWTER INDICATING OHMMETER; one switchboard type indicates continuously their resistance while carrying operative current.



Portable Type VC

Some of the most important features are:—

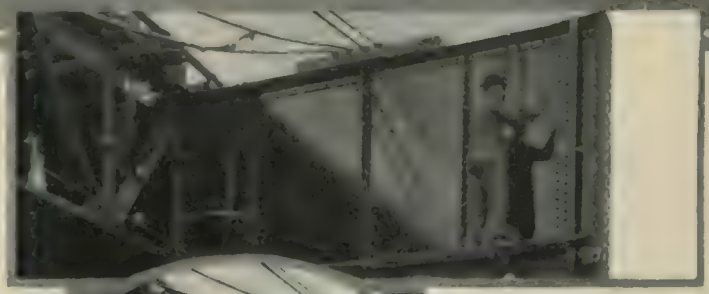
1. Simplicity of operation.
2. Reliability at all times.
3. Accuracy of indications.
4. Uniform scale.
5. Independent of variations in voltage.
6. Independent of variations in magnetic flux.
7. Self contained.
8. No magnetic shunt to be adjusted.
9. No calibration to be made before using.
10. Correctly damped.
11. Rugged in construction.
12. Range practically unlimited.
13. Is by far the best resistance measuring instrument ever offered the testing public.

Supplied for ALL practical resistance measurements, with uniform scale of three or more ranges and full scale deflection from micro-ohms to meg-ohms.

Write for Descriptive Circular

THOMPSON-LEVERING COMPANY, Philadelphia, Pa., U. S. A.

SPRACO PNEUMATIC PAINTING EQUIPMENT





The Safety of your passengers depends on the weakest spots of your structure.

Handbrushes cannot get into every crevice and cranny; a

SPRACO PAINT GUN WILL

it consequently prevents rust and the deterioration of girder joints and bolted plates.

Besides making for safety, a Spraco Paint Gun, wielded by one handy man, covers more ground than half a dozen painters with hand brushes. ALL the surface is covered, not a spot escapes the Spraco Gun.

ECONOMY—SAFETY

you are interested in both, so send for Bulletin No. 40

Spray Engineering Co., Boston, Mass.

Manufacturers also of Spraco Air Washers, Cooling Ponds, Nozzles for all purposes, Vaughan Flow Meters

SPRAY ENGINEERING CO. BOSTON, MASS.



MINIMIZE MAINTENANCE Costs with Cameron Products

Cameron Coils—Wound to withstand that rush-hour overload that means a burnout with poorly insulated coils.

Cameron Bars—Pure hard drawn copper, giving high conductivity.

Cameron Commutators—Made tight by hydraulic pressure, eliminating loose bars and arcing brushes.

Canadian Amber—Gives soft, uniform wear and long life.

Cameron Electrical Mfg. Co., Inc.

Ansonia, Connecticut



THE CLEVELAND

IS THE FARE BOX THAT

FITS THE FARE AND FARE COLLECTION SYSTEM

It accommodates any rate of cash fare and any kind of ticket. Whether you have a flat fare, the zone system, service at cost, or the one-man car, makes no difference to the Cleveland.

THE CLEVELAND FARE BOX CO.

CLEVELAND, OHIO

CLEVELAND FARE BOXES ARE ALSO MADE IN CANADA, AT PRESTON, ONT.



RAILWAY SUPPLIES





List of Supplies

- Badges
- Buttons
- Caps
- Cap Badges
- Conductors' Punches
- Fare Tickets
- Hand Tally Registers
- Lapel Ornaments
- Signal Flags
- Ticket Punches
- Uniform Caps

For 50 years "American Brand" Sundries have been foremost in the electric railway industry.

Durable, economical, satisfactory in every way, they still maintain that quality for which they were awarded first place at the Pan-American Exposition.

Write for prices



AMERICAN RAILWAY SUPPLY CO.
134-136 CHARLES STREET, NEW YORK

Power greater than the amount now generated by America's mightiest waterfall flows through the hundreds of thousands of

Triggerlock Controller Fingers

in actual service each day.

They are standard on over 300 Electric Railways. Made within sound of the soft thunder of **Niagara Falls** they have rapidly won themselves a place wherever they have been tried, and have been faithful aids during the present period of stress.

While the assured economy of the reversible and interchangeable tip is apparent, it is only in actual service that their full value is appreciated. We make fingers for all types of controllers, starters, trucks, compensators, etc., which are perfected in every possible way.

Write for our new catalogue
Note change of firm name



RUSSELL MANUFACTURING COMPANY

814-18 Bath Ave., Niagara Falls, N. Y. **557 King St., West, Toronto, Canada**

"I'm going to frame it!"

The speaker referred to a little Position Vacant advertisement clipped from the SEARCHLIGHT SECTION.

He reads the "Searchlight" ads *every* week. In this way he came across an advertisement that enabled him to secure just the position he has been looking forward to for many years.

The

SEARCHLIGHT SECTION

is the "Opportunity" center of the industries this paper represents. It will pay *you* to watch it each week for

Employment, Equipment and Business Opportunities

Start NOW—turn to the SEARCHLIGHT SECTION in this issue.

0004

The *Mileage* Armature Babbitt



Standard for Forty Years

GUARANTEE

We *guarantee* our Metals to be made
100 per cent of *Virgin Raw Materials*
of the *Highest Grades at All Times*

It will pay you to investigate

E. L. Post & Co., Inc., Sole Manufacturers
50 Cliff Street, New York

USG

U. S. G. on a motor or generator brush means that the United States Graphite Company was glad to stamp that brush as its product.

It means that for commutation no better brush can be procured. That that brush will prove itself thoroughly dependable under all service conditions, and greatly increases operating efficiency.

That such a brush will prove a material aid in lowering maintenance costs.

Let us figure on your requirements

THE UNITED STATES GRAPHITE COMPANY

SAGINAW, MICH., U. S. A.



Branch Offices: New York, Chicago, Philadelphia, St. Louis, Pittsburgh, Denver, Birmingham, San Francisco



Largest Miners of Graphite on This Continent

Ramapo Automatic Safety Switch Stands



RAMAPO
Automatic Switch Stands

The Automatic Safety Switch Stand if trailed when set wrong, allows the points to be thrown by the first pair of wheels, and they remain in this position until reset by hand or the switch is trailed from the other side.

The Automatic Return Switch Stand allows the points to be forced open when trailed, and they return to their original position after each pair of wheels pass. This makes the operation similar to a spring switch, which can be set for either side by the use of the stand.

"Safety First"

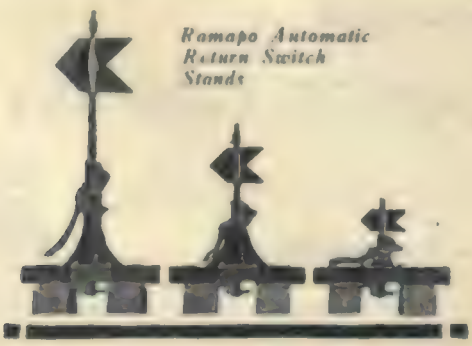
That kind of equipment must be built or purchased by a railroad which will have 100 per cent. efficiency; otherwise the railroad nullifies and negatives the safety-first idea. A "safety-first" switch stand is a good object lesson in the safety-first movement.

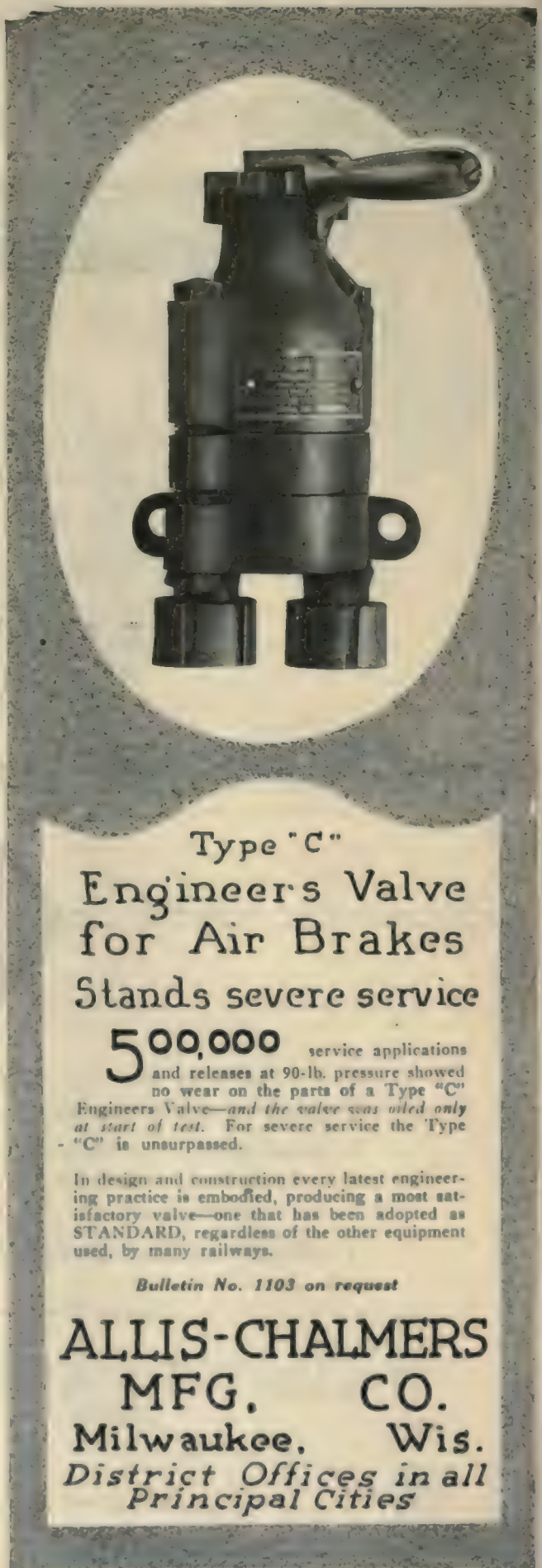
Tee Rail Special Work for Interurban Lines and Private Right-of-Ways

Manganese Construction
Street and Steam Crossings a Specialty

·RAMAPO IRON WORKS·
· HILLBURN · NEW YORK ·
Plants at HILLBURN N Y *and* NIAGARA FALLS N Y *New York Office* 30 CHURCH ST

Ramapo Automatic Return Switch Stands





Type "C"
Engineers Valve for Air Brakes
Stands severe service

500,000 service applications and releases at 90-lb. pressure showed no wear on the parts of a Type "C" Engineers Valve—*and the valve was oiled only at start of test.* For severe service the Type "C" is unsurpassed.

In design and construction every latest engineering practice is embodied, producing a most satisfactory valve—one that has been adopted as STANDARD, regardless of the other equipment used, by many railways.

Bulletin No. 1103 on request

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wis.
District Offices in all Principal Cities



TRADE MARK

AJAX



Ajax Car Brasses—Car Brasses produced by Ajax Metal Co., are still leaders in their field after 40 years. Made with the same precision and accuracy as a car wheel.

Ajax Check Plates—Made of our Perfecto Bronze which will bend before it will break. Outlast all other check plates.

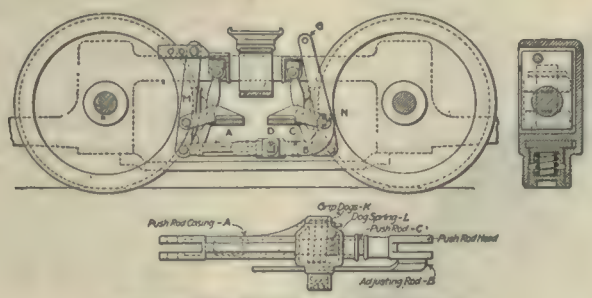
Ajax Bull Babbitt—Physically, Chemically and Scientifically, the *correct* Babbitt. A Lead Base Babbitt with splendid anti-frictional qualities. The most economical and dependable lining for car brasses.

Specify Ajax products for new equipment and repairs

THE AJAX METAL COMPANY

Main Office and Works: Philadelphia, Pa. **Established 1880** **Southern Plant: Birmingham, Ala.**

GOULD SLACK ADJUSTERS



DETAILS OF THE GOULD TYPE SLACK ADJUSTER AS APPLIED TO AN ELECTRIC CAR TRUCK

Assure Safety at All Times in Braking

A predetermined piston travel is always maintained. The motorman is assured the same braking power at all times.

Economy is another feature which should not be overlooked. All manual adjustment of brakes is done away with, less power consumed in car operation and a great saving in the wear and tear of the complete car equipment is effected.

Gould Slack Adjusters pay for themselves in a very short time.

GOULD COUPLER COMPANY

30 East 42nd Street, New York ***Works: Depew, Y.*** **Rookery Bldg., Chicago**

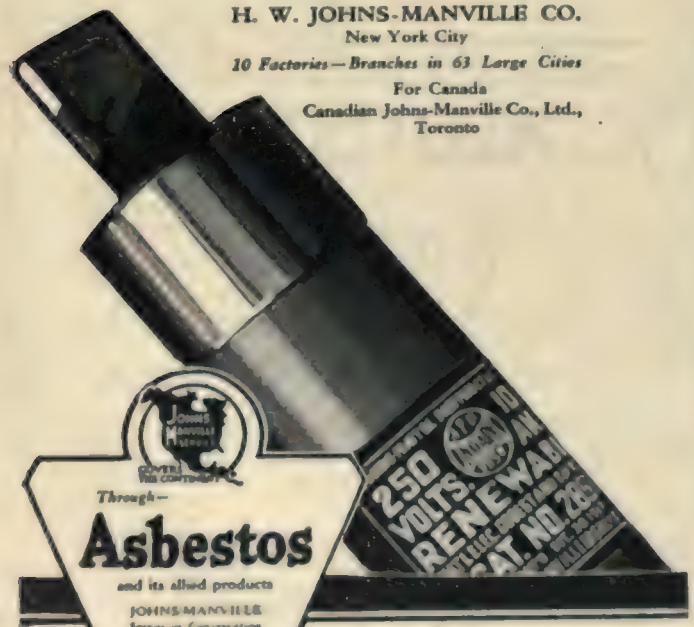
Positive action

THE desirable features that are inherent in the "Noark" fuse, are the result of care in design manufacture and inspection. They mean positive action.

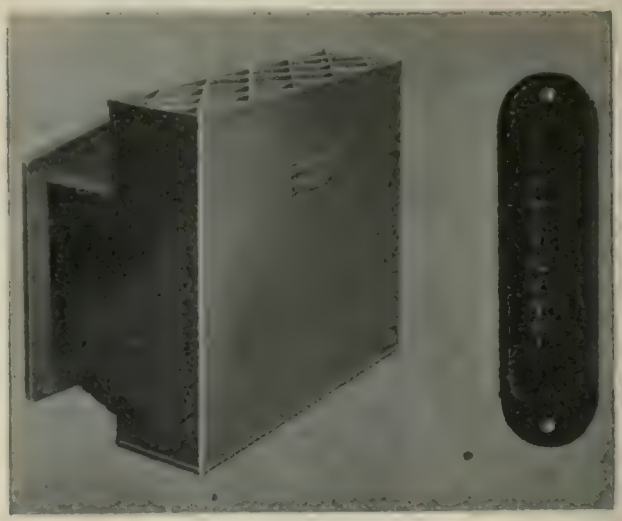
They are the result of care that refuses to take a chance where the safety of electrical apparatus is concerned—care that enables you to put complete reliance in a renewable fuse—the "Noark."

"Noark" Fuses and all other Johns-Manville packaged Electrical Materials are distributed strictly through jobber-dealer channels on a basis that gives full protection to all concerned. Dealers can get all details from their jobber. Jobbers, for samples and complete information, should apply to the Electrical Department of the nearest Johns-Manville Branch.

H. W. JOHNS-MANVILLE CO.
New York City
10 Factories—Branches in 63 Large Cities
For Canada
Canadian Johns-Manville Co., Ltd.,
Toronto



JOHNS
MANVILLE
ELECTRICAL MATERIALS



135,000 UTILITY Ventilators and 193 Electric Railways Using UTILITY Heater Regulators

135,000 UTILITY VENTILATORS in service on electric and steam railways throughout the country speaks well for the efficiency of this equipment. The advance of our ventilator to the point where we can cite the above statements represents development—concentration to the achievement of a device which will adequately exhaust the air of a car whether it is moving or stationary and accomplish this automatically.

You will find in the UTILITY Ventilator a means of adequately ventilating your cars at a reasonable installation and extremely low maintenance cost.

UTILITY Honeycomb Ventilators operate on the suction principle which creates a strong exhaust, keeping the air in the car always pure and fresh, regardless of whether the car is moving or standing still. Especially serviceable on one-man cars.

There are a number of good points about this equipment of which we will be pleased to advise you in detail.

The UTILITY Heater Regulator

The UTILITY Heater Regulator is far preferable to the "point" system of electric heater regulation, because it saves heating current.

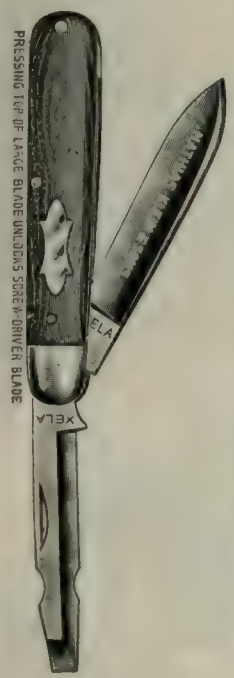
Many roads are saving annually 50% or more in their car-heating bills, frequently reaching the equivalent of $60 to $70 per car per year.

We have notably improved this regulator recently and will send full description on request.

RAILWAY UTILITY CO.
151 W. 22nd Street, Chicago

J. H. DENTON, Eastern Mgr., 1328 Broadway, New York
O. W. MEISSNER, Representative, 10 St. Antoine St., Montreal.
F. O. GRAYSON, 600 La Salle Bldg., St. Louis, Mo.

USEFUL
ELECTRICIANS' KNIFE



A handy combination for the electrician, combining an emergency screw driver, a knife blade for cutting or stripping wire; locked so that it cannot close during use. The commendable features are a well-tempered blade, a strong joint, a solid well-proportioned hand-fitting handle and a lock to keep the blade securely open, yet promptly releasable when it is desired to close the blades. Screw driver blade is locked when open; to unlock, press down on large blade.

Mathias Klein & Sons
Canal Station 25, Chicago

Page & Hill Poles
Produced by Modern Methods



The use of modern equipment like this Caterpillar Drive Steam Log Hauler in every process of pole making—from the cutting of the timber to the Butt-Treating and shipping of the finished article—enables us to furnish you with poles that are standing the most rigid test of all—the test of time.

PAGE & HILL CO.

Minneapolis Chicago New York Kansas City
Dallas Houston Louisville

HIGH-GRADE TRACK WORK

SWITCHES—MATES—FROGS—CROSSINGS
COMPLETE LAYOUTS
IMPROVED ANTI-KICK BIG-HEEL SWITCHES
HARD CENTER AND MANGANESE CONSTRUCTION

New York Switch & Crossing Co.
Hoboken, N. J.

1870 - EUGENE F. PHILLIPS - 1882 AMERICAN ELECTRICAL WORKS

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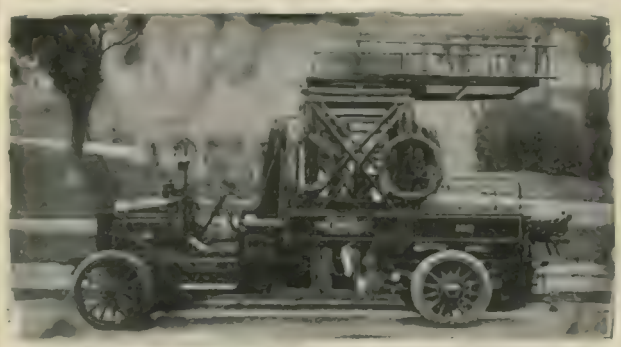
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HANDYVAR is a black, air-drying varnish for quick repair work and for a finishing coat to exclude oil and moisture. It dries to handle in 15 minutes. $2.60 per gallon.

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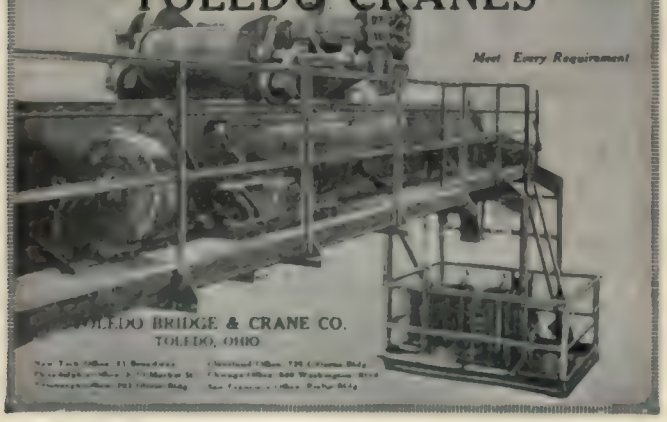
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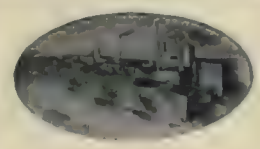
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Full power with High or Lower Adjustment

Many emergencies requiring a powerful jack present a difficulty in bringing the jack to bear on the load. The

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saves time, strength and trouble. The many positions to which it is adjustable easily solve perplexing lifting problems. Full details in our catalog. Write for it.



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The subscription was discontinued because a "Want" advertisement brought results

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Mistah Jackson—"'Tain't dat, sah, 'tain't dat. Mah wife jes' been an' dun landed a job o' wuk for me by advertisin' in youh darned ole papah."

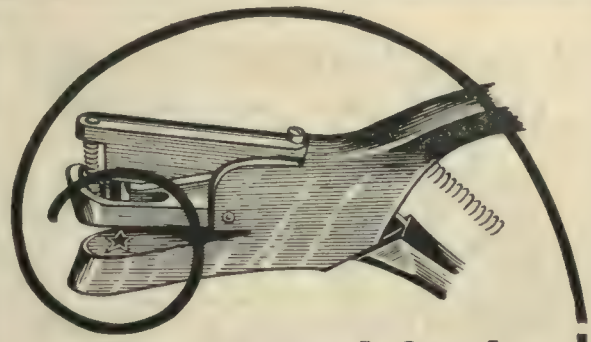
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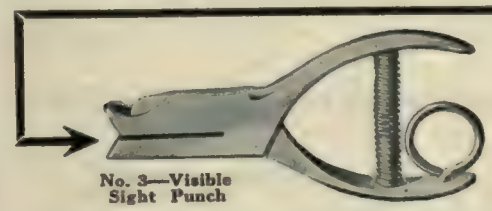


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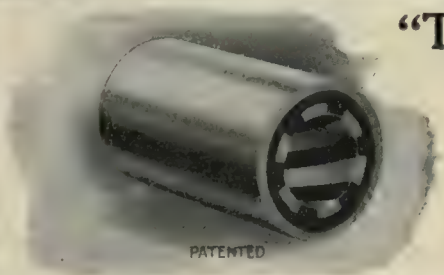
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Car Heating and Ventilation

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Applied to front windows will positively shed water and prevent condensation.

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This man received an increase of 30 per cent in his salary

—because he had the business judgment to announce this want in the Searchlight of Electric Railway Journal.

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He writes:

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His Ad. ran four times at a cost of $2
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ABSOLUTELY NON-SLIPPING ALWAYS
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Experienced Men for Electric Shop and Car House Work

2—Painters
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Steady permanent positions for good men

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AUDITOR, experienced electric lighting and railway auditor seeks change. High grade executive. 17 years' utility, manufacturing and public accounting. Administration school graduate. Mechanically and electrically trained. Salary $4,000 to start. East preferred, but not essential. PW-604, Elec. Ry. Journal, Real Estate Trust Bldg., Philadelphia.

GENERAL manager, now employed, desires to make change. Twenty years' experience in construction and operation. Good education. Highest references. PW-607, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

MAN experienced car barn; on controllers, air brakes, trucks and motors; desires position near Trenton, N. J. PW-609, Elec. Ry. Journal.

MAN, 14 years' experience with large street, railway, light, power and gas properties as accountant, assistant to general manager, secretary, treasurer and auditor solicits change. Age 40; large of statue, physically sound with good personality. A-1 references. Address PW-601, Elec. Ry. Journal.

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OPERATING statistics, new business possibilities and rate data prepared and analyzed. Accounts prepared and audited. EWW-602, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia, Penn.

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Sales representative and engineer, 38 years of age, past 10 years with leading railway supply organization, will establish connection as manufacturer's agent or representative, steam and electric railway supplies on commission basis with salary guarantee; $7,500 minimum. Member of Western Railway Club, Western Society of Engineers, American Institute of Electrical Engineers, Illinois Athletic Club. Twenty years extensive acquaintance, Chicago and Middle West, guarantees capable and efficient representation. Previous executive experience Western district manager. AS-608, Elec. Ry. Journal, Old Colony Bldg., Chicago.

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2 150 KW. Gen. Elec., type TC4A, rotary converters, 3-phase, 25 cycle, 373 v. a. c. to 600 v. 250 amp. d. c.; each with 3-60 KW. type H 25 cycle 6600-375 v. oil-cooled indoor type transformers; also both a. c. and d. c. control panels with instruments, speed 750; all in fine condition, immediate shipment. Gregory Electric Co., 16th & Lincoln St., Chicago.

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12—Differential 20-yd. Cars.
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Get our List and Prices.
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4—Center Entrance, All-Steel Cars, Plain Arch Roof, 35 ft. over bumpers, Taylor Double Trucks.

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Complete. Splendid Condition. Full details upon request.

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Commonwealth Bldg., Philadelphia, Pa.

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Line material including 500,000 base copper feeder wire, hangers, steel poles, etc.

Oil switches, feed water heaters, feed water pumps.

Obtain itemized list from the Purchasing Agent.

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The equity in the rights, property and franchises of

THE GROTON AND STONINGTON STREET RAILWAY COMPANY

represented by all of the shares of the capital stock of that company free from all claims except a bonded debt of $475,000 at 5 per cent.

This property consists of 23 miles of track in the towns of Groton and Stonington in the State of Connecticut, with all necessary property and equipment—it serves many populous and thriving comunities and does a gross business of, approximately, $8,000 per mile. Full particulars upon application.

By order of the court, I am authorized to receive bids for the above street railway property.

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GUARANTEED

10,000 Tons New 12-lb. to 100-lb., and fastenings.
40,000 Tons New Open-hearth, first quality, 80 lb.
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Rails cut to lengths for all purposes.

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RAILS—

5000 tons No. 1, 70-lb. relaying steel rails.

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6 Babcock & Wilcox boilers, 165-lb. pressure, equipped with American stokers, forced and induced draft, and economizers.
Corliss Engines.
Generators.
Switchboards and Transformers.
Rotary Converters.

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5 Box Cars, no motors.
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Write or wire us, stating just what you are interested in, and we will be pleased to submit quotations and further particulars.

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Builder ..... Baldwin Locomotive Works
Length Over All ..... 25 ft. 0 in.
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In perfect condition ready for immediate service. Westinghouse automatic air brakes, D-2-E-G compressors, MCB spring couplers. Truck base, 12 ft. 0 in. Speed, 18 M.P.H. Weight, 45,000 lbs. Larger motors could be substituted and the ends weighted to make it a heavier machine.

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Builder ..... Baldwin
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Wheels, diameter, 33-in.; Thread,, 4-in.; Flange ⅞-in.

ELECTRICAL EQUIPMENT

Consists of four Westinghouse No. 79 Motors and one L-4 Controller.

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16-lb. Rails, angle bars, bolts and nuts
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2—500 H.P. B. & W. Boilers, in fair condition, water tube.

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ROTARY CONVERTERS—60 CYCLE

2—300 kw. Westinghouse Rotary Converters, 600-v. d.c., 3-ph., 60-cy., 370-v. a.c., speed 600 r.p.m.

2—300 kw. General Electric Rotary Converters, 600-v. d.c., 3-ph., 60-cy., 370-v. a.c., speed 1200 r.p.m.

2—200 kw. Westinghouse Rotary Converters, 600-v. d.c., 3-ph., 60-cy., 370-v. a.c., speed 900 r.p.m.

1—150 kw. Westinghouse Rotary Converter, 250-v. d.c., 3-ph., 60-cy., 185-v. a.c., speed 720 r.p.m.

ROTARY CONVERTERS—25 CYCLE

2—500 kw. General Electric Rotary Converters, 600-v. d.c., 3-ph., 25-cy., 440-v. a.c., speed 375 r.p.m.

2—400 kw. Westinghouse Rotary Converters, 600-v. d.c., 3-ph., 25-cy., 370-v. a.c., speed 500 r.p.m.

2—200 kw. General Electric Rotary Converters, 125-v. d.c., 3-ph., 25-cy., 85-v. a.c., speed 375 r.p.m.

2—150 kw. General Electric Rotary Converters, 575-v. d.c., 3-ph., 25-cy., 360-v. a.c., speed 750 r.p.m.

COMPLETE TURBO UNIT EQUIPMENT

1—2500/3000 kw. Horizontal Westinghouse Turbo Unit, generator wound for 3-ph., 60-cy., 2300-v. Steam end adapted for 200/225 lb. steam pressure, 150 deg. superheat; entirely overhauled within last twelve months; complete with direct connected exciter, Deane Jet Condenser, motor driven air pump and circulating pump, also free exhaust valve and all intermediate connections and gaugeboard. Can be seen in operation—ready for instant delivery.

COMPLETE CONDENSING EQUIPMENTS

2—Complete Surface type Wheeler Condensing Equipments, 2000 sq.ft. capacity each. There is with each equipment air pump and circulating pump; also intermediate piping, in fact complete condensing equipment with exception of free exhaust valve.

ELECTRIC LOCOMOTIVES

8—10-ton single end Baldwin-Westinghouse Electric Locomotives, class 4-2C; 30-in. gauge, approximate weight 21,000 lb. each. Equipment consists of 2—50 hp. motors. Dimensions, width overall 4 ft. 4½ in.; length 15 ft., complete with every possible detail.

TRANSFORMERS—25 CYCLE

3—200 kva., NEW, Kuhlman single phase, 13,200/6600, 440/220-v.

3—1250 kva., Westinghouse O. I. S. C., single phase, 33,000, 2300-v.

3—375 kva., Allis-Chalmers air cooled, single phase, 6400, 440-v.

3—195 kva., Gen. Elec. air cooled, single phase, 2300, 430-v.

3—150 kva., Gen. Elec. single phase, 6200/6600, 220/440-v.

3—150 kw. Gen. Elec. air blast, single phase, 6000, 85-v.

3—125 kw. Westinghouse oil cooled, single phase, 6600, 440-v.

FREQUENCY CHANGER SETS

1—600 kva., Allis-Chalmers Frequency Changer Set, 3-ph., 60-cy., 2300-v. on one end, 3-ph., 25-cy., 6600-v. on the other, speed 300 r.p.m., with direct connected exciter.

1—400 kw. Gen. Elec., one end being type ATB., 425 kw., 3-ph., 25-cy., 6000-v., and the other end being 400 kw., type ATB., 3-ph., 60-cy., 2400-v., speed 375 r.p.m

TRANSFORMERS—60 CYCLE

3—150 kva., NEW Kuhlman single phase, 13,200/6600, 440/220-v.

3—100 kva., NEW, Kuhlman single phase, 13,200/6600, 2200-v.

3—75 kva., NEW, Kuhlman single phase, 13,200/6600/4400/2200, 440/220-v.

3—50 kva., NEW, Kuhlman single phase, 4400/2200, 440/220-v.

3—500 kva., Westinghouse single phase, 25,400, 13,800-v.

6—350 kva., Gen. Elec. oil cooled, single phase, 13,000/12,800/12,600/12,400/6500, 600-v.

2—200 kva., Gen. Elec. air cooled, single phase, 9200/460-v.

3—200 kva., Gen. Elec. air cooled, single phase, 2200, 370-v.

3—150 kva., Bullock oil cooled, single phase, 2180/2300/2420, 440-v.

4—150 kw. Allis-Chalmers single phase, 33,000, 2300-v.

3—100 kw. Gen. Elec. single phase, 6600, 2200-v.

3—50 kva., Gen. Elec. type H., single phase, 5700/6600, 110/220/440-v.

3—50 kva., Westinghouse, single phase, 7600, 220/110-v.

ALSO have large stock electric motors, transformers and dynamos of every character in small sizes. Send us a list of your requirements.

ELECTRICAL-&-STEAM-MACHINERY

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

Advertising, Street Car
Collier, Inc., Barron G

Air Aftercoolers
Ingersoll-Rand Co

Air Receivers
Ingersoll-Rand Co.

Air Rectifiers
Holden & White, Inc.

Ammeters
Weston Elec'l Instrument Co.

Amusement Devices
Skee-Ball Co.

Anchors, Guy
Chance Co., The.
Electric Service Supplies Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Angle Bars
Lackawanna Steel Co.

Anti-Climbers
Railway Improvement Co.

Ash Storage Tanks, Cast Iron
Green Engineering Company

Automobiles and Buses
Brill Co., The J. G.
White Co., The

Axle Straighteners
Columbia M. W. & M. I. Co.

Axles, Car Wheel
Bemis Car Truck Co.
Brill Co., The J. G.
Cambria Steel Co.
Midvale Steel & Ordnance Co
St. Louis Car Co.
Standard Steel Works Co.
Taylor Electric Truck Co.
Westinghouse Elec. & M. Co.

Babbitt Metal
Ajax Metal Co.
More-Jones Brass & Metal Co.

Babbitt Metal Holding Compound
Poidyright Compound Co.

Babbitting Devices
Columbia M. W. & M. I. Co.

Badges and Buttons
American Railway Supply Co.
Electric Service Supplies Co.
International Register Co., The
Western Electric Co.

Batteries, Dry
Johns-Manville Co., H. W.
Western Electric Co.

Batteries, Storage
Electric Storage Battery Co.
Western Electric Co.

Bearings and Bearing Metals
Ajax Metal Co.
Bemis Car Truck Co.
Brady Brass Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
More-Jones Brass & Metal Co.
Post & Co., Inc., E. L.
St. Louis Car Co.
Taylor Electric Truck Co.
Westinghouse Elec. & M. Co.

Bearings, Center and Roller Side
Holden & White, Inc.
Stucki Co., A.

Bearings, Roller & Ball
Railway Roller Bearing Co.

Bells and Gongs
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
St. Louis Car Co.
Western Electric Co.

Benders, Rail
Niles-Bement-Pond Co.
Reading Specialties Co
Western Electric Co
Wharton Jr. & Co., Wm
Zelnicker, Walter A., Supply Co., Inc.

Boiler Cleaning Compounds
Johns-Manville Co., H. W.

Boiler Coverings
Johns-Manville Co., H. W.

Boilers
Babcock & Wilcox Co.

Boiler Tubes
National Tube Co.

Bond Testers
American Steel & Wire Co.

Bonding Apparatus
American Steel & Wire Co.
Electric Railway Improv. Co.
Electric Service Supplies Co.
Ohio Brass Co.

Bonds, Rail
Electric Railway Improv. Co.
Electric Service Supplies Co.
General Electric Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Westinghouse Elec. & M. Co.

Bond Testers
Roller-Smith Co.

Book Publishers
McGraw-Hill Book Co., Inc.

Boring Tools, Car Wheel
Niles-Bement-Pond Co.

Braces, Rail
Kilby Frog & Switch Co.

Brackets and Cross Arms. (See also Poles, Ties, Posts, Etc.)
American Bridge Co.
Bates Expanded Steel Truss Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Hubbard & Co.
Lindsley Bros. Co.
Ohio Brass Co.
Western Electric Co.

Brake Adjusters
Gould Coupler Co.
Holden & White, Inc.
National Ry. Appliance Co.
Smith-Ward Brake Co.
Westinghouse Traction Brake Co.

Brake Shoes
Amer. Brake Shoe & Fdry. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Taylor Electric Truck Co.

Brakes, Brake Systems and Brake Parts
Ackley Brake & Supply Corp.
Allis-Chalmers Mfg. Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co
General Electric Co.
Holden & White, Inc.
National Brake Co.
St. Louis Car Co.
Safety Car Devices Co.
Taylor Electric Truck Co.
Westinghouse Traction Brake Co.

Bricks, Fire
Green Engingering Co.

Bridges & Buildings
American Bridge Co.

Brooms, Track, Steel or Rattan
Paxson Co., J. W.
Western Electric Co.
Zelnicker, Walter A., Supply Co., Inc.

Brushes, Carbon
General Electric Co.
Jeandron, W. J.
Martindale Electric Co.
Morgan Crucible Co.
National Carbon Co.
United States Graphite Co.
Western Electric Co.
Westinghouse Elec. & M. Co.

Brushes, Graphite
United States Graphite Co.

Brush Holders
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.
Flower, D. B.

Buckets
Blaw-Knox Co.

Bunkers, Coal
American Bridge Co.

Bushings, Case Hardened and Manganese
Bemis Car Truck Co.

Bushings, Graphite and Wooden
Bound Brook Oilless Bearing Co.

Bushings, Trolley Wheel
Ives Co., H. B.

Cables. (See Wires and Cables)

Carbon Brushes. (See Brushes, Carbon)

Car Equipment. (For Fenders, Heaters, Registers, Wheels, etc., see those headings)

Car Trimmings. (For Curtains, Registers, Doors, Seats, etc., see those headings)

Car Panel Safety Switches
Westinghouse Elec. & Mfg. Co.

Cars, Dump
Differential Car Co.

Cars, Passenger, Freight, Express, etc.
American Car Co.
Brill Co., The J. G.
Cambria Steel Co.
Kuhlman Car Co., G. C.
McGuire-Cummings Mfg. Co.
Midvale Steel & Ordnance Co.
National Ry. Appliance Co.
St. Louis Car Co.
Wason Mfg. Co.

Cars, Second Hand
Electric Equipment Co.

Car, Self-Propelled
Electric Storage Battery Co.
General Electric Co.

Castings, Brass, Composition or Copper
Ajax Metal Co.
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.
More-Jones Brass & Metal Co.

Castings, Gray Iron and Steel
American Steel Foundries
American Bridge Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Standard Steel Works Co.
Wharton Jr. & Co., Wm.

Castings, Malleable and Brass
Amer. Brake Shoe & Fdry. Co
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.

Catchers and Retrievers, Trolley
Earll, Chas. I.
Electric Service Supplies Co.
Holden & White, Inc.
Ohio Brass Co.
Wood Co., Chas. N.

Ceiling, Car
Keyes Products Co.

Checks, Employees'
American Railway Supply Co.

Circuit Breakers
Cutter Electrical & Mfg. Co., The
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps and Connectors for Wires and Cables
Anderson Mfg. Co., A. & J. M.
Dossert & Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hubbard & Co.
Klein & Sons, Mathias
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Cleaners and Scrapers—Track (See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.
Ohio Brass Co.
Western Electric Co.

Clusters and Sockets
General Electric Co.

Coal and Ash Handling. (See Conveying and Hoisting Machinery)

Coasting Recorders
Railway Improvement Co.

Coil Banding and Winding Machines
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Western Electric Co.

Coils, Armature and Field
Cleveland Armature Works
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Rome Wire Co.
Westinghouse Elec. & M. Co.

Coils, Choke and Kicking
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Coin-Counting Machines
Electric Service Supplies Co
International Register Co., The
Johnson Fare Box Co.

Comelong
Bush Electric Co.

Commutator Slotters
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co

Commutator Truing Devices
General Electric Co.

Commutator or Parts
Cameron Electrical Mfg. Co
Cleveland Armature Works
Columbia M. W. & M. I. Co
Eureka Co.
General Electric Co.
Mica Insulator Co.
Western Electric Co.
Westinghouse Elec. & Mfg Co

Commutator Slotters
Martindale Electric Co., The

Commutator Stones
Martindale Electric Co.

Compressors, Air
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Trac. Brake Co.

Compressors, Gas
Ingersoll-Rand Co.

Concrete Mixers
Blaw Knox Co.

Concrete Products
Massey Concrete Products Co.

Condensers
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg Co

Conduit Fittings
Chicago Fuse Mfg. Co.

Conduits, Flexible
Tubular Woven Fabric Co.

Conduits, Underground
Johns-Manville Co., H. W.
Western Electric Co.

Connectors, Solderless
Dossert & Co.
Frankel Connector Co.
Westinghouse Elec. & Mfg. Co.

Controller Fingers
Russell Mfg. Co



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Single Phase
WATTMETER

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New York	Cleveland	Denver	Buffalo	Seattle	Winnipeg
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Philadelphia	St. Louis	Pittsburgh	New Orleans	Montreal	Calgary, Alta.
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Controllers or Parts
Allis-Chalmers Mfg. Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Johns-Manville Co., H. W.
Russell Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Controller Regulators
Elec. Service Supplies Co.

Controlling Systems
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Converters, Rotary
Allis-Chalmers Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Conveyors, Belt
Portable Machinery Co.

Conveyors, Coal and Ash
Green Eng. Co.
Portable Machinery Co.

Conveyors, Portable
Portable Machinery Co.

Conveying and Hoisting Machinery
American Bridge Co.
Columbia M. W. & M. I. Co.
Green Eng. Co.
Portable Machinery Co.

Cooling Systems
Spray Eng. Co.

Copper Expansion Joints
Wheeler Mfg. Co., C. H.

Copper Wire
Anaconda Copper Mining Co.

Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Roebling's Sons Co., John A.
Samson Cordage Works

Cord Connectors and Couplers
Electric Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.

Couplers, Car
Brill Co., The J. G.
Gould Coupler Co.
Ohio Brass Co.
Van Dorn Coupler Co.
Westinghouse Trac. Brake Co.

Cranes
Allis-Chalmers Mfg. Co.
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The

Creosoting. (See Wood Preservatives)

Cross Arms. (See Brackets)

Crossing Foundations
International Steel Tie Co.

Crossing Signals. (See Signals, Crossing)

Crossings, Track. (See Track, Special Work)

Crushers, Rock
Allis-Chalmers Mfg. Co.

Culverts
Armco Iron Culvert & Flume Mfgrs. Assn.
Canton Culvert & Silo Co.
Stark Rolling Mill Co.

Culvert Pipe Concrete
Massey Concrete Products Co.

Curtains and Curtain Fixtures
Brill Co., The J. G.
Du Pont Fabrikoid Co.
Edwards Co., Inc., The O. M.
Electric Service Supplies Co.
St. Louis Car Co.

Cutouts
Chicago Fuse Mfg. Co.

Dealers' Machinery
Archer & Baldwin
Cleveland Armature Works
Electric Equipment Co.
Foster Co., L. B.
Griswold Machine Co., Geo. M.
Hyman-Michaels Co.
MacGovern & Co., Inc.
Zelnicker Supply Co., Inc., Walter A.

Derailing Devices. (See also Track Work)
Cleveland Frog & Crossing Co.
Wharton Jr. & Co., Wm.

Destination Signs
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Detective Service
Wish Service P. Edward

Dogs, Lathe
Williams & Co., J. H.

Door Operating Devices
Consolidated Car Heating Co.
National Pneumatic Co., Inc.
Safety Car Devices Co.

Doors, Asbestos
Johns-Manville Co., H. W.

Doors and Door Fixtures
Brill Co., The J. G.
Edwards Co., Inc., The O. M.
General Electric Co.
Hale & Kilburn Corp.

Doors, Folding Vestibule
National Pneumatic Co., Inc.

Draft Rigging. (See Couplers)

Drills, Rock
Ingersoll-Rand Co.

Drills, Track
American Steel & Wire Co.
Chicago Pneumatic Tool Co.
Electric Service Supplies Co.
Niles-Bement-Pond Co.
Ohio Brass Co.

Drinking Cups, Sanitary Paper
Individual Drinking Cup Co., Inc.

Dryers, Sand
Electric Service Supplies Co.
Zelnicker Supply Co., Inc., Walter A.

Electrical Wires and Cables
Roebling's Sons Co., J. A.

Engineers, Consulting, Contracting and Operating
Archbold-Brady Co.
Arnold Co., The
Clark Management Corp., E. W.
Drum & Co., A. L.
Engel & Hevenor
Feustel, Robert M.
Ford, Bacon & Davis
Holst, Englehardt W.
Jacobs & Co., J. L.
Republic Engineers, Inc.
Richey, Albert S.
Robinson & Co., Dwight P.
Sanderson & Porter
Scofield Engineering Co.
Stone & Webster
Wells, Gardiner F.
White Companies, The J. G.
Woodmansee & Davidson Engineering Co.

Engines, Gas and Oil
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Engines, Steam
Allis-Chalmers Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Exhaust Gate Valves
Wheeler Mfg. Co., C. H.

Extension Platforms, Trap Doors
Edwards Co., Inc., The O. M.

Fabricated Steel
Blaw-Knox Co.

Fare Boxes
Brill Co., The J. G.
Cleveland Fare Box Co.
Johnson Fare Box Co.
National Railway Appliance Co.
Ohmer Fare Register Co.

Fences, Woven Wire and Fence Posts
American Steel & Wire Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Cleveland Fare Box Co.
Consolidated Car Fender Co.
Electric Service Supplies Co.
Star Brass Works
Western Electric Co.

Fibre and Fibre Tubing
Johns-Manville Co., H. W.
Westinghouse Elec. & Mfg. Co.

Field Coils. (See Coils)

Filters, Water
Scaife & Sons Co., Wm. B.

Fire Extinguishing Apparatus
Castle, Inc., James M.
Johns-Manville Co., H. W.

Fire-Proofing Material
Johns-Manville Co., H. W.

Floodlights
Electric Service Supplies Co.

Flooring Composition
American Mason Safety Thread Co.
Johns-Manville Co., H. W.
Western Electric Co.

Flooring, Grating
Irving Iron Works

Forgings
Columbia Machine Works & M. I. Co.
Eureka Co.
Standard Steel Works Co.
Williams & Co., J. H.

Frogs, Track. (See Track Work)

Furnaces. (See Stokers)

Fuses and Fuse Boxes
Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Johns-Manville Co., H. W.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co., J. W.

Fuses, Refillable
Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
General Electric Co.
Martindale Electric Co., The

Fuse, Removers
Bush Electric Co.

Gages, Oil and Water
Ohio Brass Co.

Gaskets
Johns-Manville Co., H. W.
Power Specialty Co.
Westinghouse Traction Brake Co.

Gas-Electric Cars
General Electric Co.

Gas Producers
Westinghouse Elec. & Mfg. Co.

Gates, Car
Brill Co., The J. G.

Gear Blanks
Standard Steel Works Co.

Gear Cases
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Thayer & Co., Inc.
Westinghouse Elec. & Mfg. Co.

Gears and Pinions
Ackley Brake & Supply Corp.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
National Railway Appliance Co.
Nuttall Co., R. D.
Poole Eng. & Machine Co.
Tool Steel Gear & Pinion Co.

Gears, Reduction
Poole Eng. & Machine Co.

Generating Sets, Gas-Electric
General Electric Co.

Generators
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Western Electric Co.

Gongs. (See Bells and Gongs)

Graphite
Morgan Crucible Co.

Grates, Chain
Green Eng. Co.

Greases. (See Lubricants)

Grinders and Grinding Supplies
Indianapolis Switch & Frog Co.
Metal & Thermit Corp.
Railway Track-work Co.
Western Electric Co.

Grinding Blocks and Wheels
Railway Track-work Co.

Guards, Cattle
American Bridge Co.

Guards, Trolley
Electric Service Supplies Co.
Ohio Brass Co.

Harps, Trolley
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Electric Service Supplies Co.
Hensley Trolley & Mfg. Co.
Moore-Jones B. & M. Co.
Nuttall Co., R. D.
Star Brass Works
Western Electric Co.

Headlights
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
St. Louis Car Co.

Headlining
Keyes Products Co.

Heaters, Car (Electric)
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
Holden & White, Inc.
National Ry. Appliance Co.
Smith Heater Co., Peter

Heaters, Car, Hot Air and Water
Cooper Heater Co.
Holden & White, Inc.
Smith Heater Co., Peter

Heaters, Car (Stove)
Electric Service Supplies Co.
Holden & White, Inc.
Smith Heater Co., Peter

Hoists and Lifts
Columbia M. W. & M. I. Co.
Duff Mfg. Co.
Ford-Chain Block Co.
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The

Hose
Ingersoll-Rand Co.

Hose, Bridges
Ohio Brass Co.

Hose, Pneumatic & Fire
Johns-Manville Co., H. W.

Houses, Station & Watchmen's Concrete
Massey Concrete Products Co.

Hydraulic Machinery
Allis-Chalmers Mfg. Co.
Niles-Bement-Pond Co.

Inspection
Electrical Testing Lab's

Institutions, Educational
Alexander Hamilton Institute

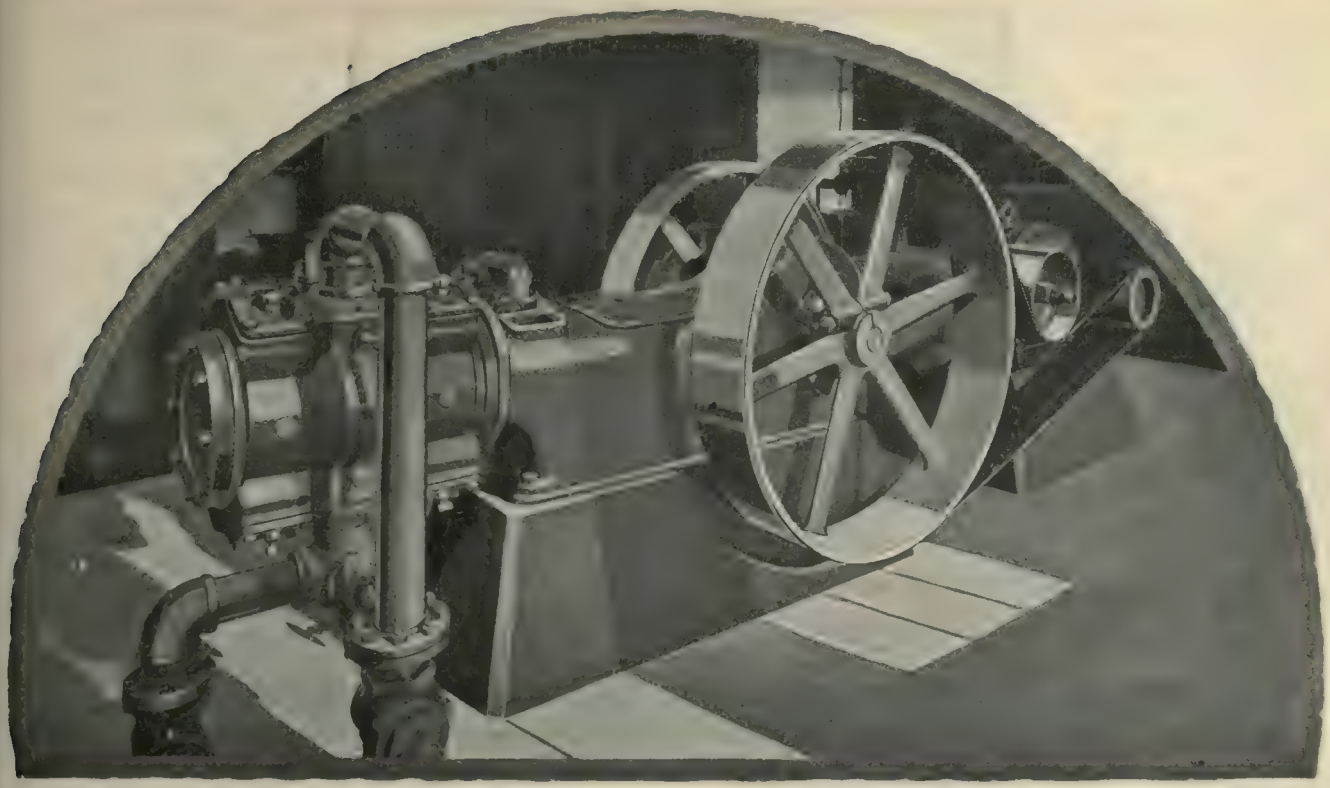
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General Electric Co.
Johns-Manville Co., H. W.
Roller-Smith Co.
Thompson-Levering Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Insulating Cloth, Paper and Tape
General Electric Co.
Johns-Manville Co., H. W.
Mica Insulator Co.
Okonite Co.
Standard Underground Cable Co.
U. S. Rubber Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Insulations. (See also Paints)
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Electric Ry. Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Holden & White, Inc.
Johns-Manville Co., H. W.
Mitchell-Rand Mfg. Co.
Okonite Co.
U. S. Rubber Co.
Western Electric Co.
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Insulating Machinery
American Insulating Machinery Co.

Insulators. (See also Line Material)
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Drew Electric & Mfg. Co.



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KOBE, JAPAN
TOKIO, JAPAN
HONOLULU, T. H.
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Locke Insulator Mfg. Co.
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Thomas & Sons Co., R.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Insulator Pins
Electric Service Supplies Co.
Hubbard & Co.

Jacks. (See also Cranes, Hoists and Lifts)
Brill Co., The J. G.
Buckeye Jack Mfg. Co.
Columbia M. W. & M. I. Co.
Duff Mfg. Co.
Templeton, Kenly Co., Ltd.

Joints, Rail
Reading Specialties Co.
Zelnicker Supply Company, Inc., Walter A.

Journal Boxes
Bemis Car Truck Co.
Brill Co., J. G.
Railway Roller Bearing Co.

Junction Boxes
Johns-Manville Co., H. W.
Standard Underground Cable Co.

Laboratories
Electric Testing Lab's

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Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Arc and Incandescent. (See also Headlights)
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General Electric Co.
National Electric Specialty Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Signal and Marker
Ohio Brass Co.

Lathe Attachments
Williams & Co., J. H.

Lathes, Car Wheel
Niles-Bement-Pond Co.

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Holden & White, Inc.

Lightning Arrestors
Railway & Industrial Eng. Co.

Lightning Protection
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Electric Service Supplies Co.
General Electric Co.
National Electric Specialty Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co

Line Material. (See also Brackets, Insulators, Wires, etc.)
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Archbold-Brady Co.
Chance Co., The
Columbia M. W. & M. I. Co.
Dossert & Co.
Dross Electric & Mfg. Co.
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Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Holden & White, Inc.
Hubbard & Co.
Johns-Manville Co., H. W.
Locke Insulator Mfg. Co.
Moore-Jones B. & M. Co.
Ohio Brass Co.
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Westinghouse Elec. & Mfg. Co.

Loaders, Wagon, Truck or Car
Portable Machinery Co.

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General Electric Co.
McGuire-Cummings Mfg. Co
Westinghouse Elec. & Mfg. Co.

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Galena-Signal Oil Co.
Texas Co., The
Universal Lubricating Co.

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Lubricants, Oil and Grease
Galena-Signal Oil Co.
Texas Co., The
Universal Lubricating Co.

Machine Tools
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Niles-Bement-Pond Co.

Machine Work
Columbia M. W. & M. I. Co.
Holden & White, Inc.

Mats
Johns-Manville Co., H. W.

Meters, Car, Watt-Hour
Economy Electric Devices

Meters. (See Instruments)
Electric Service Supplies Co.

Mica
Mica Insulator Co.

Mirrors for Motormen
Drew Elec. & Mfg. Co.

Motormen's Seats
Electric Service Supplies Co.
Wood Co., Chas. N.

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Westinghouse Elec. & Mfg. Co.

Motor Leads
Dossert & Co.

Motors and Generators, Sets
General Electric Co.

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Wheeler Mfg. Co., C. H.

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Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Hubbard & Co.

Ohmmeters
Weston Elec'l Instrument Co.

Oils. (See Lubricants)

Oxy-Acetylene. (See Cutting Apparatus, Oxy-Acetylene)

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Johns-Manville Co., H. W.
Post & Co., Inc., E. L.
U. S. Rubber Co.
Westinghouse Traction Brake Co.

Packing Rings
Johns-Manville Co., H. W.

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Johns-Manville Co., H. W.
Martindale Electric Co.
Mica Insulator Co.
Mitchell-Rand Mfg. Co.

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Johns-Manville Co., H. W.

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Skee-Ball Co.

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Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
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Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse Traction Brake Co

Pipe
National Tube Co

Pipe Fittings
Power Specialty Co.
Standard Steel Works Co.
Westinghouse Traction Brake Co.

Planers. (See Machine Tools)

Pliers, Insulated
Electric Service Supplies Co.

Pneumatic Tools
Ingersoll-Rand Co.

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Hubbard & Co.

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Bates Expanded Steel Truss Co
Electric Railway Equipment Co
Hubbard & Co.

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Drew Elec. & Mfg. Co.

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Lindsley Bros. Co.
Northern White Cedar Assn.
Page & Hill Co.
Southern Cypress Mfgrs. Assn.
Western Electric Co.

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Massey Concrete Products Co.

Poles and Ties, Treated
Lindsley Bros. Co.
Page & Hill Co.
Western Electric Co.

Poles, Trolley
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
National Tube Co.
Nuttall Co., R. D.

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Electric Railway Equipment Co.
National Tube Co.

Potheads
Okonite Co.

Power Saving Devices
Arthur Power-Saving Recorder Co.
Economy Electric Devices Co.
National Ry. Appliance Co.
Railway Improvement Co.

Power Transmission Machinery
Poole Eng. & Machine Co.

Pressure Regulators
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Pumps
Allis-Chalmers Mfg. Co.
Schutte & Koerting Co.

Punches, Ticket
American Railway Supply Co.
Bonney-Vehslage Tool Co.
International Register Co., The
Wood Co., Chas. J.

Purifiers, Feed Water
Scaife & Sons Co., Wm. B.

Rails
Foster Co., L. B.
Lackawanna Steel Co.

Rails, New
Cambria Steel Co.
Midvale Steel & Ordnance Co.

Rail Grinders (See Grinders)

Rail Joint Plates
Lackawanna Steel Co.

Rail Welding (See Brazing and Welding Processes)

Rails, Relaying
Foster Co., L. B.
Zelnicker, Walter A., Supply Co. Inc.

Railway Safety Switches
Westinghouse Elec. & Mfg. Co.

Rattan
Brill Co., The J. G.
Electric Service Supplies Co.
Hale & Kilburn Corp.
McGuire-Cummings Mfg. Co.
St. Louis Car Co.

Recorders, Power Saving
Arthur Power-Saving Recorder Co.

Registers and Fittings
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Ohmer Fare Register Co.
Rooke Automatic Register Co.

Reinforcement, Concrete
American Steel & Wire Co.

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Electric Service Supplies Co.

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Columbia M. W. & M. I. Co.
General Electric Co.
Independent Lamp Wire Co.
Westinghouse Elec. & Mfg. Co.

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Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Reading Specialties Co.

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Columbia M. W. & M. I. Co.

Resistance, Wire and Tube
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Retrievers, Trolley (See Catchers and Retrievers, Trolley)

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American Car & Foundry Co.

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Johns-Manville Co., H. W.

Roofing Car
Johns-Manville Co., H. W.
Keyes Products Co.

Rheostats
General Electric Co.
Mica Insulator Co.
Westinghouse Elec. & Mfg. Co.

Rubber Specialties of All Kinds
U. S. Rubber Co.

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Brill Co., The J. G.
Cleveland Fare Box Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Holden & White, Inc.
Ohio Brass Co.
St. Louis Car Co.

Sash Balances
Edwards Co., Inc., The O. M.

Sash Fixtures, Car
Brill Co., The J. G.
Edwards Co., Inc., The O. M.

Sash Metal, Car Window
Hale & Kilburn Corp.

Scrapers, Track (See Cleaners and Scrapers, Track)

Seats, Car (See also Rattan)
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Hale & Kilburn Corp.
St. Louis Car Co.

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Du Pont Fabrikoid Co.

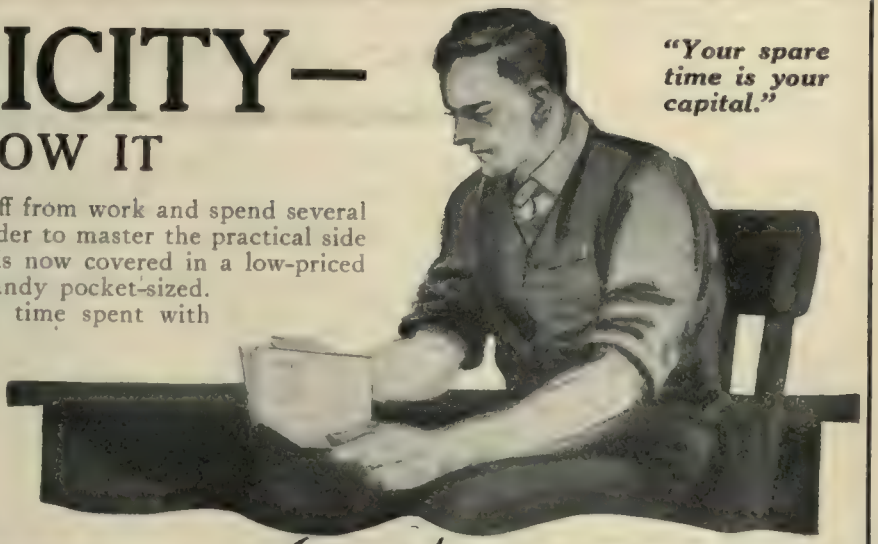
Second-Hand Equipment
Archer & Baldwin
Cleveland Armature Works
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Griswold Machine Co., G. M.
Hyman Michaels Co.
MacGovern & Co., Inc.
Zelnicker Supply Co., Inc., Walter A.

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Nachod Signal Co., Inc.
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Wood Co., Chas. N.

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Nachod Signal Co., Inc.
U. S. Electric Signal Co.

Slack Adjusters. (See Brake Adjusters)

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Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Holden & White, Inc.
More-Jones Brass & Metal Co.
Nuttall Co., R. D.

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Columbia M. W. & M. I. Co.
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Solderless Connectors
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Speed Transformers
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Westinghouse Elec. & Mfg. Co.

Splicing Sleeves. (See Clamps and Connectors)

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Bemis Car Truck Co.
Brill Co., The J. G.
Standard Steel Works Co.
Taylor Electric Truck Co.

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McGuire-Cummings Mfg. Co.
St. Louis Car Co.

Steel Forms
Blaw-Knox Co.

Steps, Car
American Mason Safety Tread Co.
Irving Iron Works
Universal Safety Tread Co.

Steps, Ladder and Stair (non-slipping)
Irving Iron Works

Steps, Safety
Irving Iron Works

Stokers, Mechanical
Babcock & Wilcox Co.
Green Engrg. Co.
Westinghouse Elec. & Mfg. Co.

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Strand
Roebling's Sons Co., J. A.

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Railway Improvement Co.

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Structural Steel
Lackawanna Steel Co.

Subway Grating
Irving Iron Works

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Railway & Industrial Eng. Co.

Superheaters
Babcock & Wilcox Co.
Locomotive Superheater Co.
Power Specialty Co.

Surface, Set & Barometric Condensers
Wheeler Mfg. Co., C. H.

Sweepers, Snow. (See Snow Plows, Sweepers and Brooms)

Switch Stands
Indianapolis Switch & Frog Co.
Kilby Frog & Switch Co.
Ramapo Iron Works
Wharton Jr. & Co., Wm.

Switches, Track. (See Track Special Work)

Switchboxes
Chicago Fuse Mfg. Co.

Switches and Switchboards
Allis-Chalmers Mfg. Co.
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Synchroscopes
Weston Elec'l Instrument Co.

Tampers, Tie
Ingersoll-Rand Co.

Tanks, Ash and Coal Storage
Green Engineering Co.

Tanks, Oil Storage
Milwaukee Tank Works

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Western Electric Co.

Terminals, Cable
Standard Underground Cable Co.

Testing, Commercial and Electrical
Elec'l Testing Laboratories

Testing Instruments. (See Instruments, Electrical Measuring, Testing, etc.)

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Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
Holden & White, Inc.
Railway Utility Co.
Smith Heater Co., Peter

Thread-Cutting Tools
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Tickets & Transfers
American Railway Supply Co.
Globe Ticket Co.

Tie Plates
Cambria Steel Co.
Lackawanna Steel Co.
Midvale Steel & Ordnance Co.

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Dayton Mechanical Tie Co.

Ties and Tie Rods, Steel
American Bridge Co.
Barbour-Stockwell Co.
International Steel Tie Co.

Ties, Wood Cross (See Poles, Ties, Posts, etc.)

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Tools, Linemen's
Rush Electric Co.

Tools, Track and Miscellaneous
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Chicago Pneumatic Tool Co.
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Hubbard & Co.
Johns-Manville Co., H. W.
Klein & Sons, Mathias
Railway Track-work Co.

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New York Switch & Crossing Co.
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St. Louis Frog & Switch Co.
Wharton Jr. & Co., Wm.

Track Bolts & Spikes
Lackawanna Steel Co.

Transfer Issuing Machines
Ohmer Fare Register Co.

Transfer Tables
American Bridge Co.
Archbold-Brady Co.

Transfers. (See Tickets)

Transformers
Allis-Chalmers Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Treads, Safety, Stair, Car Step
American Mason Safety Tread Co.
Universal Safety Tread Co.

Trolley Bases
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Electric Service Supplies Co.
General Electric Co.
Holden & White, Inc.
Nuttall Co., R. D.
Ohio Brass Co.

Trolley Bases, Retrieving
Ackley Brake & Supply Corpn.
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General Electric Co.
Holden & White, Inc.
Nuttall Co., R. D.
Ohio Brass Co.

Trolleys and Trolley Systems
Ford Chain Block Co.

Trolley Shoes
Holden & White, Inc.
Miller Trolley Shoe Co.

Trolley Wheels. (See Wheels, Trolley)

Trolley Wire
American Steel & Wire Co.
Anaconda Copper Mining Co.
Roebling's Sons Co., John A.
Rome Wire Co.

Trucks, Automobile
White Co., The

Trucks, Car
American Steel Foundries
Bemis Car Truck Co.
Brill Co., The J. G.
McGuire-Cummings Mfg. Co.
St. Louis Car Co.
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Tubing, Steel
National Tube Co.

Turbines, Steam
Allis-Chalmers Mfg. Co.
General Electric Co.
Terry Steam Turbine Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

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Allis-Chalmers Mfg. Co.

Turnstiles
Perry Mfg. Co., Inc.

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Wheeler Mfg. Co., C. H.

Vacuum Impregnation
Allis-Chalmers Mfg. Co.

Valves
Ohio Brass Co.
Schutte & Koerting Co.
Westinghouse Traction Brake Co.

Varnishes. (See Paints, etc.)

Vending Machines, Drinking Cup
Individual Drinking Cup Co., Inc.

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Brill Co., The J. G.
Holden & White, Inc.
National Railway Appliance Co.
Railway Utility Co.
St. Louis Car Co.

Vises, Pipe
Williams & Co., J. H.

Voltmeters. (See Instruments)

Wash Saturation Systems
Milwaukee Tank Works

Water Cooling Towers
Wheeler Mfg. Co., C. H.

Water Softening & Purifying Systems
Scaife & Sons Co., Wm. B.

Wattmeters
Weston Elec'l Instrument Co.

Welded Rail Joints
Indianapolis Switch & Frog Co.

Welders, Portable Electric
Electric Railway Improvement Co.
Indianapolis Switch & Frog Co.

Welding Processes and Apparatus
Electric Railway Improvement Co.
General Electric Co.
Metal & Thermit Corp.
Westinghouse Elec. & Mfg. Co.

Wheel Guards. (See Fenders and Wheel Guards)

Wheel Presses. (See Machine Tools)

Wheels, Car, Cast Iron
Assn. of Mfrs. of Chilled Car Wheels
Bemis Car Truck Co.
Griffin Wheel Co.

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American Steel Foundries
Bemis Car Truck Co.
Standard Steel Works Co.

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Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Heasley Trolley & Mfg. Co.
Johns-Manville Co., H. W.
More-Jones B. & M. Co.
Nuttall Co., R. D.
Star Brass Works

Whistles, Air
General Electric Co.
Ohio Brass Co.
Westinghouse Traction Brake Co.

Window Cleaners
Block Automotive Co.

Wire Rope
American Steel & Wire Co.
Roebling's Sons Co., John A.

Wires & Cables
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American Elec'l Works
American Steel & Wire Co.
Anaconda Copper Mining Co.
Copper Clad Steel Co.
D & W Fuse Co.
General Electric Co.
Martin-Rockwell Corp'n
Okonite Co.
Roebling's Sons Co., John A.
Rome Wire Co.
Standard Underground Cable Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Wood Preservatives
Lindsley Bros. Co.

Woodworking Machinery
Allis-Chalmers Mfg. Co.

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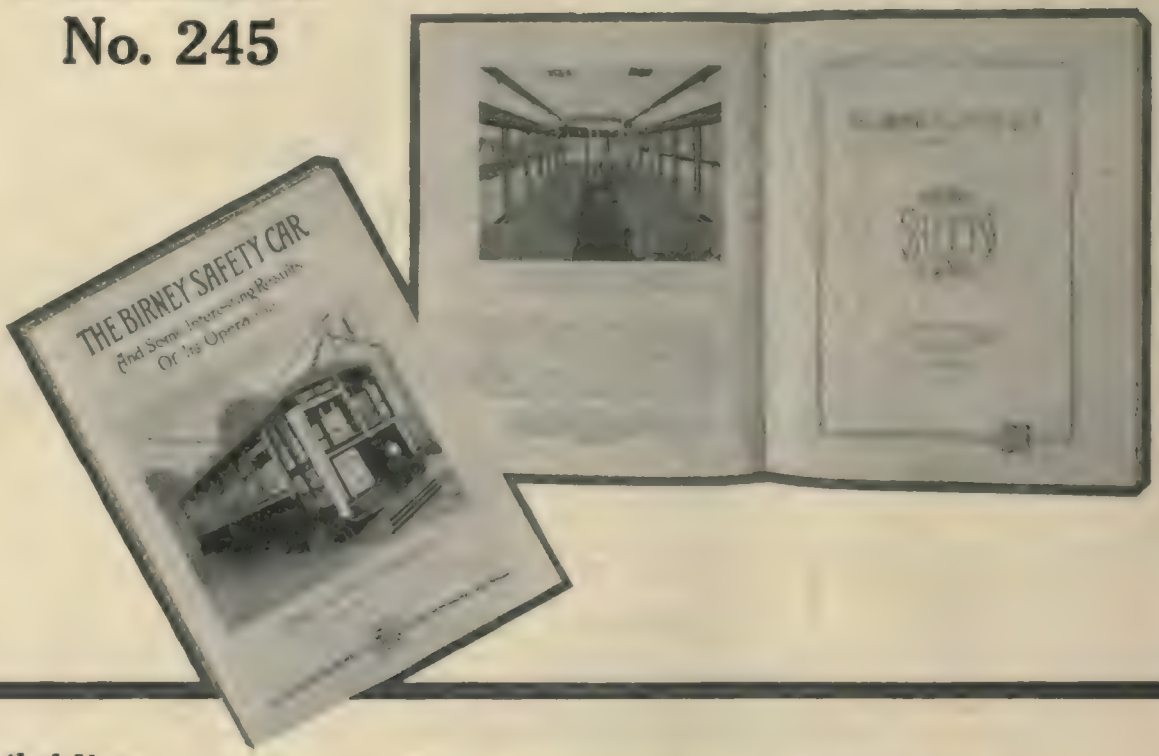
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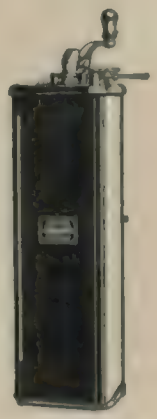


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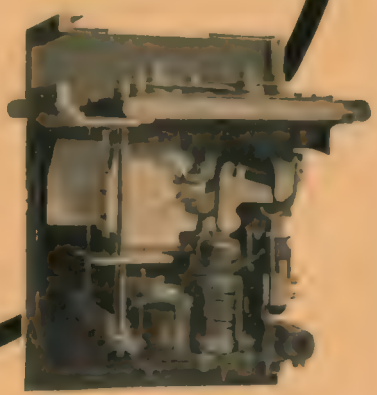
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No. 306 Motor



H L Control

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Vol. 55, No. 13 New York, March 27, 1920 Pages 631–678

Electric Railway Journal

H. W. BLAKE, *Editor*

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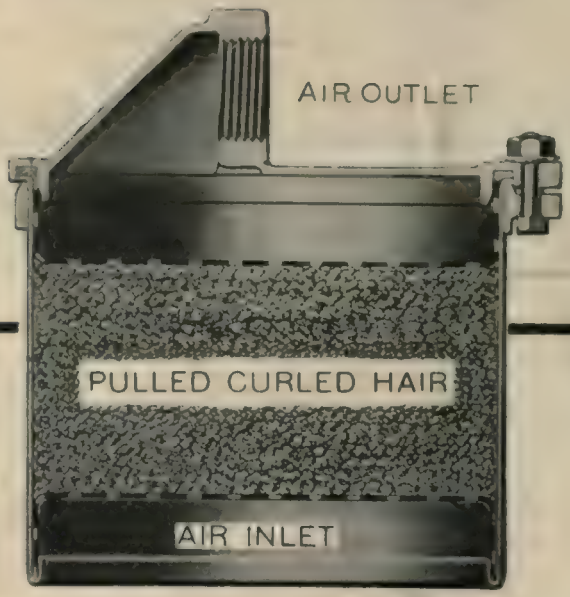
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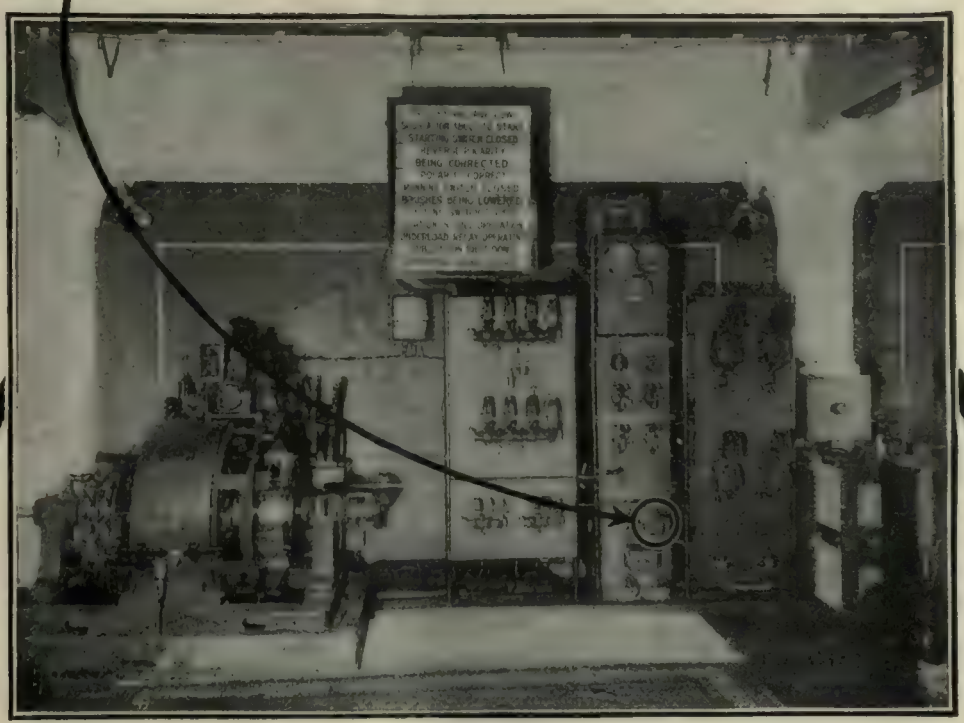
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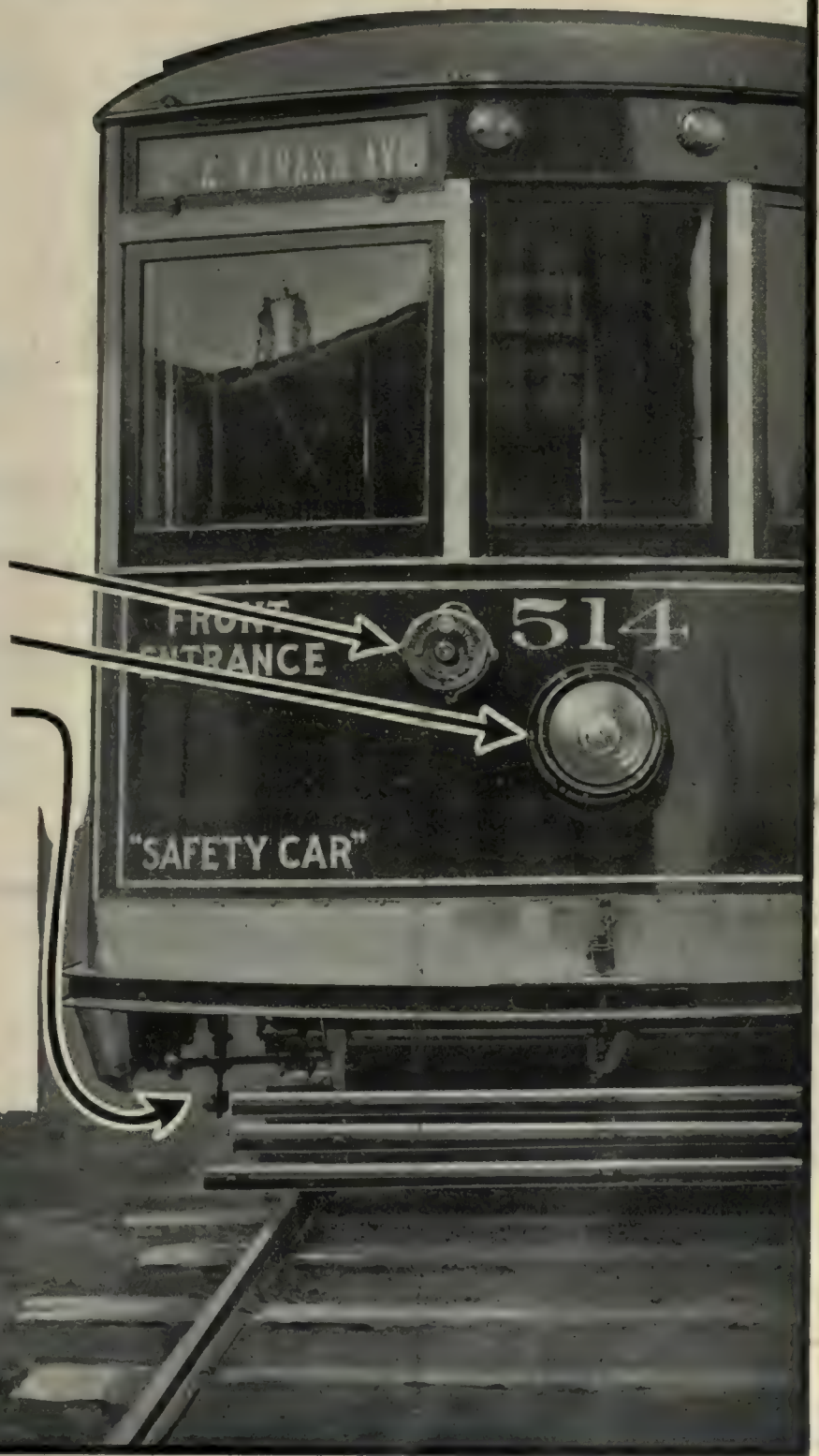
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11—No. 00 W.P.

No. 3. 3—No. 00 Stranded Bar
3—No. 2 Stranded Bar

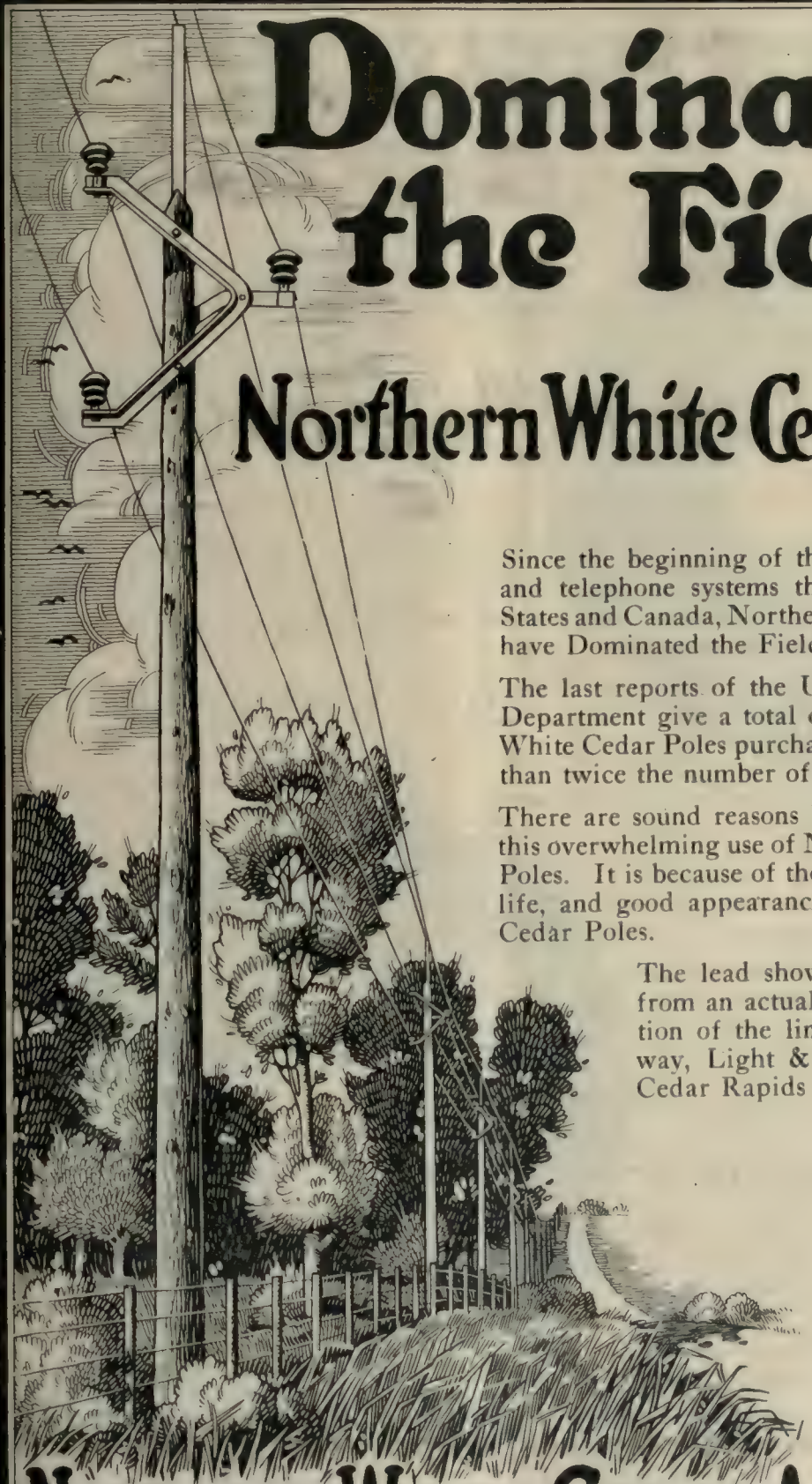
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Northern White Cedar Poles



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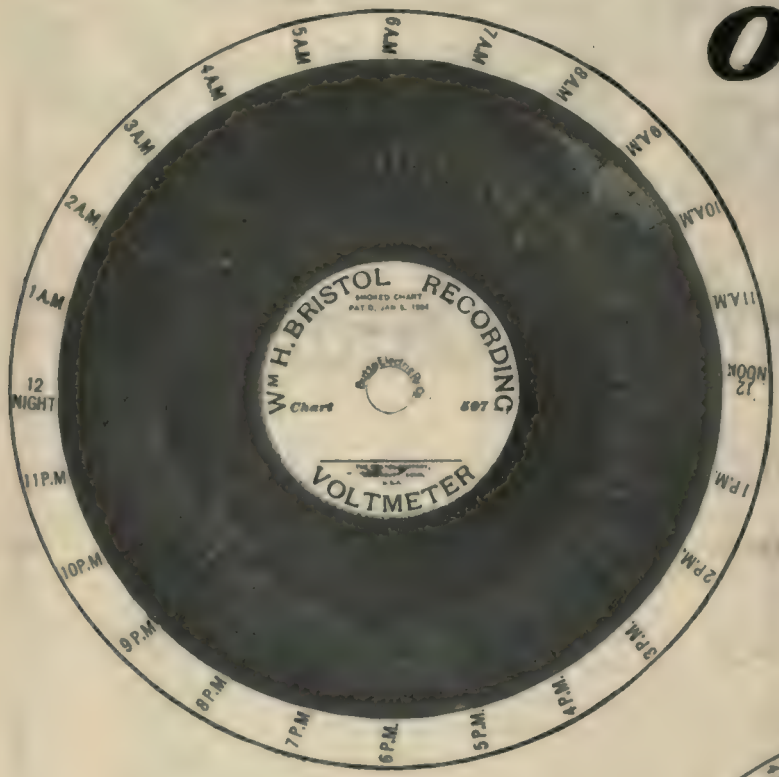
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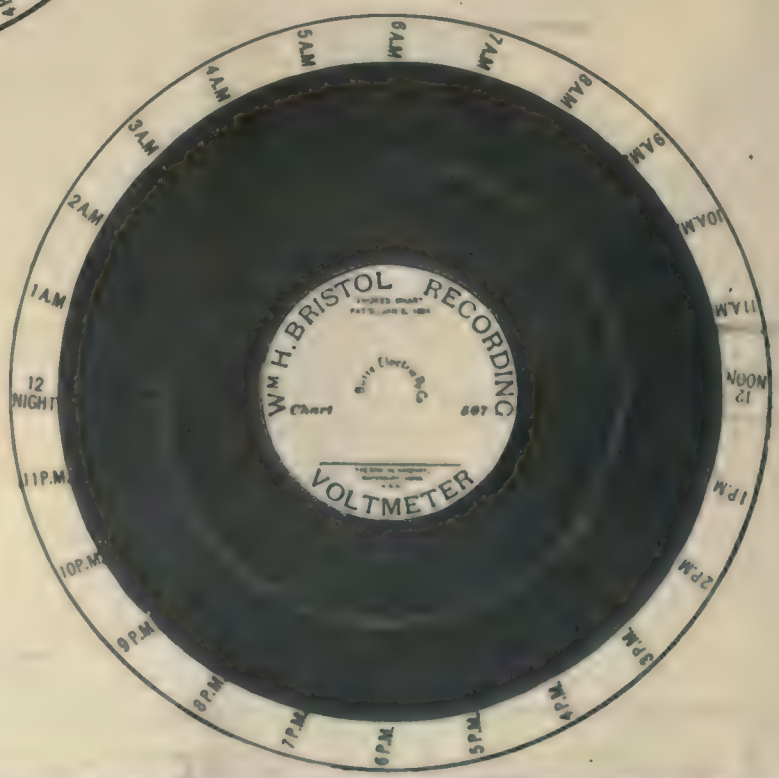
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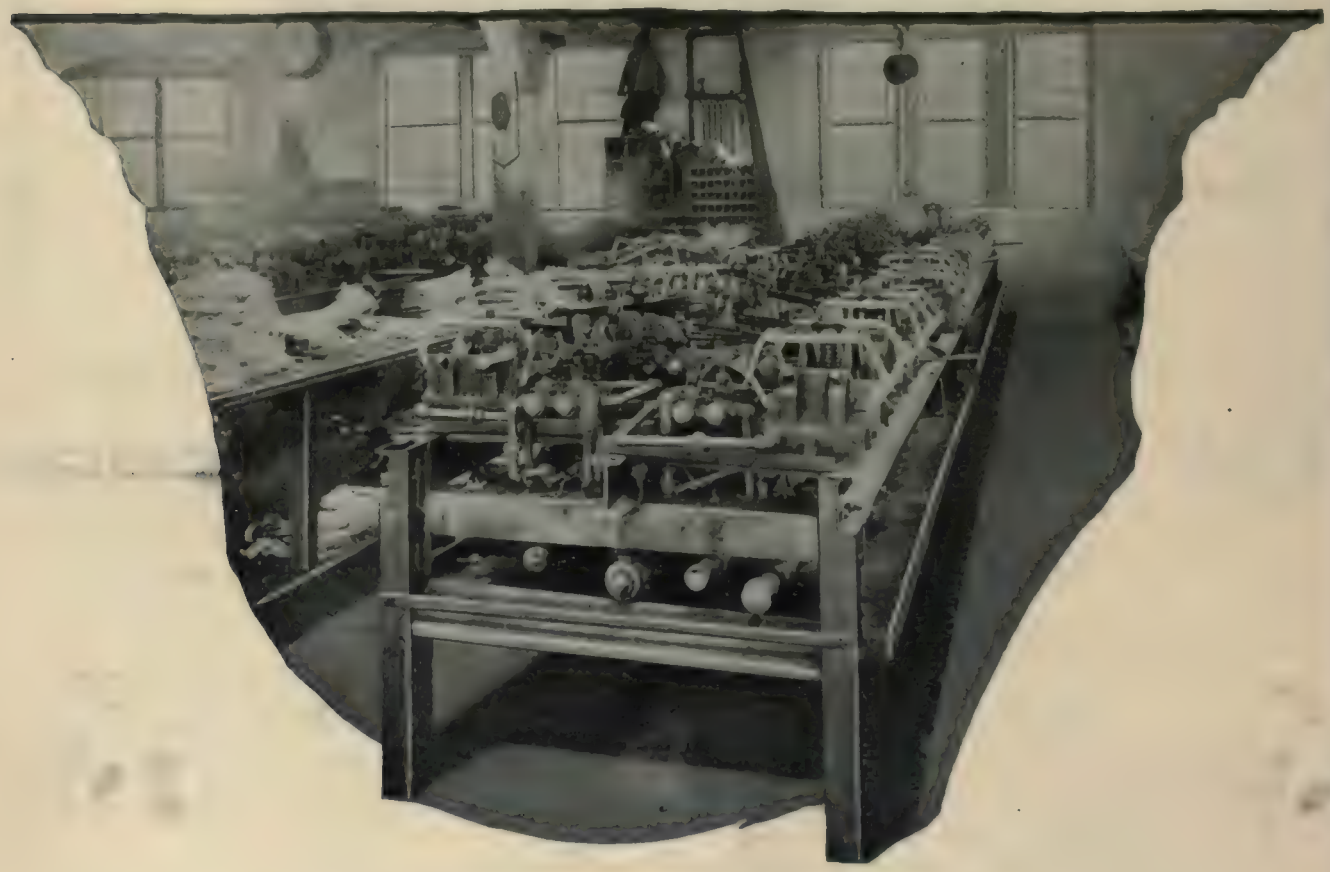
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Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Volume 55 New York, Saturday, March 27, 1920 *Number* 13

An Ounce of Prevention Would Be Worth Several Pounds of Cure in This Case

THE severe snowstorms which visited the eastern part of the country last month gave a trying test to the snow-fighting methods and facilities of the electric railways. In the main the railways met the contingency with gratifying success. Only in New York City, and to be exact only in the Borough of Manhattan, have we heard of any serious difficulty in keeping lines open during one of the most peculiar snowstorms with which railway men have ever had to contend. And in Manhattan it was the underground conduit, always susceptible to sleet storms, which caused the trouble.

The interest in snow-fighting methods has naturally been aroused and we have endeavored by correspondence with engineers on several properties to find out what methods or improvements therein have been adopted. From the replies received to our inquiries we believe that there have been practically no changes in method, although considerable improvement in details of apparatus has been noted.

The essential factor in snow fighting, as expressed by our correspondents, is preparedness—preparedness through having a sufficient amount of adequate equipment together with a definite program for handling it upon the road when the storms come.

It has been impressed upon us that the success of our snow-fighting methods is primarily due to the prevention of accumulation of snow, which is accomplished by the snowplows and sweepers. But this sort of prevention is much more costly in the end than would be some form of prevention which could be applied to the lateral accumulation of large mounds of snow alongside the tracks. The removal of such huge snowbanks is a tedious and expensive process, while the damage to equipment and delays to schedules through stalled vehicular traffic upon the track area add costs substantially equal to those involved in the removal of the snow. Surely there is need for the concentration of our thought upon the problem of how best to prevent secondary accumulation in the roadways.

There May Be Heavy Snowstorms Next Winter

IT will be easier now than later to secure tentative appropriations for next summer's work and purchases in the line of snow-fighting equipment. That transportation superintendent is a wise one who utilizes the still vivid impression of last month's experiences to "nail" a reasonable allowance in the current budget for this purpose. To this end the Electric Railway Journal is publishing this week a number of articles which represent a comprehensive study of the snow-fighting game. One or two more will follow promptly.

It might seem that the appropriate season for consideration of snow-handling equipment and processes would be the fall, just prior to the season when machines and men must be prepared for the fray. Just the reverse, however, is the case, for time slips by apace and it is none too early now to plan and scheme. As soon as the winter's cripples are out of the shop the snow machines might well come in for attention. At any rate the subject can have some thought now, with a view to storing up information which later may be urgently needed.

In many fields, even though it were possible, it would not necessarily be the most efficient practice always to be prepared to cope with any contingency which could arise. The cost of being prepared might more than offset the savings resulting when the actual contingency did, if ever, occur. In the matter of snow handling, however, every railway should be sufficiently well equipped and prepared to cope with the worst storm which might reasonably be expected to occur in its particular locality.

Progress in Design of Curved Heads for Grooved Girder Rails

INTEREST has been renewed of late in the subject of curved-head rails through the assignment of the subject to the committee on way matters, jointly with the committee on equipment. While the thought was expressed, when this subject first came up, that there was a possibility that a suitable curved-head design might eliminate corrugation, the principal claims made for the design were more along lines of the possibilities of securing greater life both of rails and wheels through the lessening of the rates of wear.

It is now well established that corrugation is not prevented by this change in design. It has been observed, however, that where these rails have been in service, the length of time within which corrugation first appears has been extended from the few days or weeks formerly experienced to a period of about two years. Perhaps this observation may be construed as indicative of a greatly lessened rate of wear. In any event, it is of sufficient moment to warrant the adoption of the curved head as a principle of design. Meanwhile, in its report last year the way committee presented several other good reasons in support of the correctness of the curved-head principle.

Having accepted the view that the principle is correct, there remains the question of detailed application to the existing standard grooved girder rails of the association. The problem thus resolves itself into a determination of the proper contour which will be suitable to wide application, since the standard rail is intended for use throughout the country. An examination of existing designs of curved heads discloses the tendency, on widely separated properties, toward the use of a contour which takes the form of a compound curve, having an initial radius of 12 in. starting at or near the back of the head,

an intermediate radius of about 1½ in. and a final radius at the gage-line fillet of ⅝ in. This is in substantial agreement with British designs which have been in service for some years. There is every reason to believe that the average contours of both worn rails and worn wheels are so nearly alike upon different properties that the committee should be able to settle upon a design which will approximate the average wear so closely that it may be readily accepted, and we are inclined to the view that the form of contour substantially as above outlined should be selected.

It's Bus or Bust for New York!

IN OUR March 20 issue we adverted briefly to the decision taken by the Board of Estimate in New York on Friday, March 12, to invest $1,140,000 in motor buses and to engage actively in the transportation business with them in New York. Perhaps it is the privilege of youthful industries to see the future as through a glass lightly rather than darkly. Only on this assumption can we account for the rose-tinted canvases of bus promoters, whether they be of the private broker or public official tribe! Here is New York's Commissioner of Plant and Structure, who is to manage the bus department, telling the newspapers that the city actually expects to increase rather than decrease its revenues by running buses at 5 cents up to distances of 8 miles. Beyond that Alpine 8 miles, Commissioner Whalen concedes, lies trouble.

We certainly have no quarrel with the installation of one-man, 27 to 30-seat motor buses as a successor to two-men, 24-seat storage battery cars on the old interferry routes of downtown New York. We do not believe that it would have ever paid to electrify these routes on the costly conduit system demanded by the city. Permission to operate the battery cars with one man would have staved off disaster a bit longer, but after all the conditions for track operation of any kind were not particularly favorable because of the speed limitations of such cars and the congestion of the highways. For these streets, therefore, even a jitney service has proved preferable from the viewpoint of the rider. On the other hand, we see no reason for instituting direct competition with 5-cent large-car and train service, as in Brooklyn.

This is not the place to enter into another mathematical analysis of the city's futile expectation of profit from a 5-cent universal fare as we did Dec. 27, 1919. Let us, however, point out this significant fact: Of the existing jitney-bus routes in Manhattan or Brooklyn Boroughs not one comes anywhere near the 8 miles named by Mr. Whalen. With the exception of the Flatbush Avenue line, all routes now operated are 4 miles or less in length. The Flatbush Avenue line is rather exceptional in that most of the passengers ride only as far as the terminus of the Interborough and New York Municipal subways at Atlantic Avenue (less than 4 miles), and furthermore the last down-town mile of this route serves the local business and shopping district in which a certain amount of short-haul, pick-up traffic can be developed. We may conclude, then, that the economic limit of the present 5-cent motor-bus operation is 4 miles; a deduction confirmed by the fact that no operator has undertaken to give service on Route No. 8, which is about 5 miles long, although the invitation has been out since November, 1919.

A little thought should convince anybody that if subsidized individual operators will not venture beyond 4 miles for 5 cents there is no prospect whatever that an organization, whether private or public, will be able to do even as well and break even. The present operators are at a disadvantage in comparison with an organization in such matters as the purchase of supplies, but in everything else they are at an enormous advantage. If this were not the case such great jitney businesses as those of Bridgeport, Conn., and Newark, N. J., would long ago have evolved to company form. Let us see why this is so:

The individual busman pays 2 or 3 cents more a gallon for gasoline, but his fuel cost per mile is sure to be less than that of a hired man because he has a strong personal reason to use fuel, as well as lubricant, economically. The same degree of personal interest applies to the vital items of tire wear and general upkeep. Furthermore, many busmen are practical repairmen who are capable of doing their own tinkering during spare moments. Where the busman is not a mechanic his membership in a co-operative association assures a reasonable repair bill. So much, then, for fuel and maintenance.

Now take the items of gross revenue. The individual operator picks up many a fare that would be ignored by an employee busman, for the former knows that he is working upon a pretty narrow margin at best. Any one who rides around with these men for a few hours will never question the fact that they are genuine transportation salesmen. Besides picking up more customers than an employee busman, a working owner has the satisfaction of getting every fare tendered. There are no leaks, and the number of passengers who would cheat an individual is far less than the number who think it good sport to "welch" on a corporation—yea, even a municipal corporation. Again, the individual operator cannot be compelled to work during thin hours or on thin routes. An organized bus company necessarily will average a smaller intake per bus-mile because it seeks to give a definite service, rain or shine, and is willing to stick through a period of development on promising routes. In New York the individual busmen have bluntly refused to do development work.

The organization is also at a disadvantage with regard to wages. It cannot get men to work for more than eight to ten hours a day and must pay a minimum guarantee to spare men, whereas the individual operator takes no account of the flight of time. If he divided his earnings by the number of hours actually worked he would find that he had little enough velvet after paying his bills and storing up coin for a new car, but the genus busman prefers twelve hours' self-employment to eight hours under a master. Finally, in the case of New York, the present operators are spared the cost of a supervisory staff, of printing destination and fare signs and of accident insurance. The public also puts up with conditions of crowding, cleanliness and shabbiness that it would not tolerate from an organization.

When the effect of all these disadvantages is duly weighed one needs no detailed tabulation to see the unlikelihood of a profit from unlimited-ride, free-transfer 5-cent buses. As we have said before, when a municipality enters the transportation field it may obtain auxiliary benefits, such as higher land-tax values, which may more than offset the operating losses of the transportation project. Had the New York Adminis-

tration taken up the motorbus from that standpoint this comment would be superfluous, but inasmuch as the city officials are treating this project as if it were a straightaway transportation undertaking we must protest against assumptions that never can be realized and that can only cause incalculable harm to the one sane method of urban motor-bus development, *to wit:* the operation of non-competitive motor buses at special fares for special services by the local organization—the electric railway—already best acquainted with the transit needs of the community.

The Principal Activities of the A. R. E. A. Convention

AMONG the many transactions accomplished at the Chicago convention of the American Railway Engineering Association last week the adoption of a standard specification for rails, another for iron and steel structures and another for cross ties perhaps stand out as the most important. The rail specifications and the one covering iron and steel structures have been in process of compilation and revision for several years and have been studied by several committees, discussed at conventions and referred back to a new committee, so that it would now seem that the specification adopted must represent the consensus of thought and experience of the railroad engineers.

The specifications for ties came into being in a different way. During the war the United States Railroad Administration drew up a standard specification for ties and directed that it be used on all railroads. The question considered, therefore, by the committee on ties and by the convention was not so much the details of the specification as it was whether this specification, representing a single standard actually in use on all roads for two years, should be continued or whether there should be a return to the several recommended practices of the association formerly in force and the resulting multitude of standards observed by the individual roads. The committee reached the decision that it would be better to continue the single standard, and the convention confirmed this recommendation, giving the association a definite standard for cross ties.

The convention also adopted standards for a steel cut track spike, a screw track spike, for steel, wrought iron and malleable iron tie plates, for manganese steel pointed switches; a standard specification for electric light, power supply and trolley line crossings with steam roads, which was drawn up by a joint committee on which there were three representatives of the American Electric Railway Association; new specifications for creosote treatment of wood and a standard approach warning sign for railroad crossings. This list will indicate the immense amount of work accomplished in the three-day session of the association. Some of the details of interest to the electric railway field are presented in summary on other pages in this issue. Others will follow in an early issue.

One of the most interesting pieces of work undertaken by the American Railway Engineering Association is that embodied in the duties assigned to the committee on standardization, which was only recently created. This is of particular interest to the electric railway field, since it reflects a weakness in the functioning of the railroad association similar to that experienced in the American Electric Railway Association and suggests a remedy which the latter may well consider. To this committee was assigned the dual function by the board of direction of sponsoring new standards of practices, equipment and tools and of bringing about the general use of standards by the member companies. More recently the board of direction instructed this committee to confine its duties for the present to the work of securing the use of the standards already set up by the association.

This committee had not been in existence long enough at the time of the recent convention to make any very definite report, but the importance of the work of the committee was appreciated. The real benefits to be gained through the use of standards in an industry are indeed great, but these advantages cannot be realized unless the standards are generally adopted. The A. E. R. A., like the A. R. E. A., has found that many member companies were exceedingly slow about adopting standards or loath to adopt them at all. Perhaps it would be a very fortunate move for the former to create such a committee, which might act as a "selling" organization to put into practice the standards developed through the efforts of the association. We are not unmindful of the efforts of the A. E. R. A. through its committee on standards to promulgate its own standards. Special emphasis was laid upon this subject at the 1919 convention at Atlantic City. There the committee had an interesting exhibit and distributed a pamphlet containing convincing arguments for standards adoption. However, the task is a large one, and much can be gained by co-operation between the two great railway engineering societies along this line.

C. E. R. A. Looks to Economies

THE Central Electric Railway Association has made it a habit to occupy its time at conventions with papers and committee work which are of vital interest to the member companies in connection with their every-day operating practices. This habit prevailed again at the Louisville meeting last week. The attention of the members was first directed to a study of rail bonding as developed in a paper by Ralph H. Rice, which, with the discussion which followed, treated constructively every phase of the subject save one—how to prevent bonds from being stolen. Having discussed the perfection of the return system as one means of conserving power, the convention took up the savings possible in that portion of the total energy which is consumed directly by the cars. Through the able paper of Professor Ewing and some of the constructive discussion which followed, the members were much impressed by the significant economies pointed out as readily obtainable. Mr. Rice's paper was abstracted last week. Abstracts of the economy papers are given in this issue.

The Louisville meeting of the Central Association was thus true to form in providing the members with the knowledge and the impetus for better operating practices. This association has repeatedly demonstrated its great value to the electric railway industry of the Middle West states, yet its opportunities for further and greater service have in no wise been diminished. The study which is now being made looking toward the establishment of a pick-up and delivery express business over all of the interurban lines comprised in the association territory is an example of the big things which remain to be done in the future.

"Maintenance Account No. 12—Removal of Snow, Ice and Sand"

The Vital Thing Is to Prevent Accumulation of Snow—Delay in Attack Causes More Failures Than Anything Except Inadequate Equipment

BY R. C. CRAM
Engineer Surface Roadway Brooklyn Rapid Transit System

THE month of February, 1920, will long remain a milestone in the memories of operating and maintenance men. In several respects the snow and sleet storm which began on Feb. 4 and continued until the morning of Feb. 7 was one which beat the record of the famous blizzard of March, 1888. While less snow fell this year than in that memorable storm, this year's affair had a moisture content of 4½ in. as compared with 2½ in. for the 1888 record. In New York, during the three days of almost constant storm, there were five periods of rain, four periods of sleet and three periods of snow, with only one lull of about 3½ hours' duration. In consequence there is little wonder that the storm has served again to concentrate interest upon the prevailing methods of "fighting" and handling snow. Not only the railway men, in cities at least, but also the civic officials charged with street cleaning have had good reason to think seriously upon the snow removal problem.

It is worth while to note that practically all of our efforts toward the solution of the snow problem have been concerned with the matter of removal and, as one newspaper writer has put it, nearly every scheme has been tried, except possibly that of tempting Providence, to try to prevent snow from falling. However, any analysis of the problem which may be made soon develops the fact that the troubles created by a snowstorm are not due primarily to the snow itself. It is the accumulation of snow which causes the difficulties, just as it is the accumulation of water from a rainstorm. Hence it seems to be rational to suggest that more attention should be directed toward the prevention of accumulation if we are ever to get out of the trenches.

As a matter of fact, the electric railways have concentrated upon this very thing in their adoption and use of snowplows, sweepers, rotaries and special apparatus attached to heavy service cars and these prevent accumulation upon the track area. To these pieces of apparatus more than to any other agencies the railways owed the comparative success of their efforts to keep cars in operation during the first week of last February. Such appliances, combined with frequent car operation, prevented the accumulation of snow upon the track area, which otherwise would have stopped car operation entirely.

While this was the result to be sought, we must acknowledge that the net result of all such efforts was merely the transference of the accumulation from the track space to the cramped roadway areas between the tracks and the curbs. The latter areas thus received more than their share of the accumulation, for in addition these areas are also the places of deposit for all the snow from the adjacent sidewalks, diligently cleaned by the weary property owners. Thus, a further accumulation results, so that a roadway space perhaps 12 ft. wide becomes the recipient of the additional snow which has fallen over a space 17 ft. or more in width. With a 2-ft. snowfall, the 12-ft. space on each side of the car tracks, instead of receiving say 24 cu.ft. per linear foot, thus receives 62 cu.ft. per linear foot of street. These great mounds of snow confine vehicular traffic to the tracks, seriously impairing car service, and when the snow melts cause the track spaces to be literally "young canals," carrying several inches of water, through which cars must try to operate.



PUSHER USED IN BROOKLYN FOR UNLOADING SNOW FROM FLAT CARS

In cities somebody has to take this accumulation of snow away. In many of them this duty devolves upon the railway companies to a large degree wherever their tracks are found. Having once removed the snow from the tracks they are required again to remove it from the street. With a 3 or 5-in. fall of snow this may not be so much of a job, because the accumulation is not excessive, and the sun and rain probably will assist in the removal work. When the fall reaches 12 in. or more, or whenever the lesser falls drift badly, the burden upon the railways becomes almost unbearable, not only in the difficulty and cost for removal but also in traffic delays and damage to car equipment. Another source of cost lies in the excessive amount of power which is required to propel cars during such periods of weather. Surely there is good reason for further attempts to discover some method of preventing the secondary accumulation upon the roadways which is now the result of the comparatively successful methods of preventing primary accumulation upon the track area.

In spite of all the trouble which it caused, the recent storm has accomplished one good purpose. It has served to bring the fact home to the people that the electric railways are really most efficient snow-fighting machines which are constantly available and always on the job.

In the vicinity of New York, at least, it has been proved beyond cavil that without the aid of the highly organized snow-fighting apparatus of the electric railways our great cities would often be snowbound for weeks, instead of merely being inconvenienced for the few hours or days required to clear the arteries traversed by electric railway tracks.

SNOW FIGHTING IS REGULAR WARFARE

There are three distinct phases in a fight with a heavy snowfall, namely, the attack, the battle and the clean-up. Perhaps the most essential phase is that of the attack. How many of us remember saying: "Next time we'll get those plows and sweepers out as soon as a flake of snow begins to fall." More snow battles have been lost on account of delay in attack than for any other reason, except the lack of adequate apparatus with which to make the fight.

One of the most essential features of the snow-fighting problem lies in the preparation which is made for the attack. In other words, it must all be planned out ahead of time, at least six months in advance. We can never foretell what kind of a storm will come nor can the depth of the fall, the wind velocity, or the moisture content of the snow be predetermined. Consequently, preparations should always be made for the worst kind of a storm even though it involves seemingly excessive and useless expense. It is far better to be over-equipped with snow-fighting apparatus for three seasons than to be even slightly under-equipped in the fourth season. The losses of the latter will far outweigh those of the former.

On suburban and interurban properties the way department assists in preparation for the attack by the preventive measure involved in the erection of temporary and permanent snow fences, set out along the right of way at places on the windward side of cuts where snow is likely to accumulate in the form of drifts. It has been found worth while in these cases to follow steam road practice closely even to the payment of



SAFETY CAR DOES MAN-SIZED JOB AT 10 DEG. BELOW AND IN 40-MILE WIND IN LEVIS, QUEBEC

money to adjacent owners who may require this for the use of their land.

It has repeatedly been demonstrated that the chief dependence for efficient snow fighting must be placed upon snowplows, rotaries and sweepers, operated by the transportation department. The amount and character of the equipment necessarily will vary with each property and the most careful planning along this line is required. Inquiry has developed the information that most roads have at least one snowplow or sweeper for each five miles of track. Next in importance is the actual working of the apparatus thus provided during the period of the snowstorm. Here, again, planning and efficient direction of operation are the price of success in keeping the lines clear.

The work of the way department is subordinate to that of the transportation department during the storm period, but the closest co-operation is needed. Men must be furnished to go along with plows and sweepers to keep switches clear and to pay particular attention to keeping tracks at car storage yards and depots free from snow accumulation. The liberal use of salt in



TRAIN OF FLATS LOADED WITH SNOW IN BROOKLYN

switches in streets provides the surest means of keeping them in working condition.

The work of keeping switches clear has been greatly aided in recent years through the development and use of gasoline or oil-burning torches for melting snow and preventing ice formation, particularly in open yards at split switches, which are very susceptible to clogging by snow and ice. Several of the steam roads have used electric heater unit installations of the Boardman type at split switches for preventing accumulation, with a fair degree of success. (See ELECTRIC RAILWAY JOURNAL for Nov. 16, 1918.) These may become ineffective mainly when high winds prevail and the snow is blown along in a direction parallel with the tracks. So far as the writer is aware, no electric railway company has ever tried the Boardman device. Steam roads have also tried the method of equipping the switches with steam coils in yards where a supply of steam is available, but the use of this scheme is not very extensive and it is practically out of the question for most electric railways.

The way department takes up its real snow-fighting job when it begins to remove the accumulated snow after the storm has ceased. On roads having large mileages within city limits the task is not one to be classed as a "cinch," to say the least.

For instance, as the result of the February storm, the writer estimates that the quantity of snow which was piled up in the areas from which the railway companies in Brooklyn had to remove it amounted to 1,400,000 cu.yd. or 46,666 carloads, allowing 30 cu.yd. per car. The weight of such a quantity of snow may be of some interest. The Weather Bureau indicated a moisture content of 4½ in. for the 17.5 in. of snow in the Feb. 4 storm. This gives an equivalent weight of nearly 24 lb. per cubic feet of snow. On this basis the 46,666 carloads of snow weighed about 465,000 tons. As an

engineering problem in handling material this must be considered a man-sized job. Very fortunately the sun and rain assist in the task to a degree which renders it possible for us to cope with it with a fair degree of success.

In meeting such a problem the railways have so far depended largely upon manual labor for loading the cars or trucks. It has always been a custom to arrange for feeding the men, not only of the way department but also of the transportation department, during their work on snow, particularly in the night seasons. Usually arrangements are made with restaurants for furnishing hot food and coffee. It has also been found advisable to set a minimum wage rate for snow work, which is considerably above the regular minimum rate for track laborers. This has the effect of getting the men out and tends to prevent their seeking snow work in other quarters.

Within the last year or two there has been an increase in the use of steam or electric shovels for loading snow whenever there was a sufficient accumulation. Their use is somewhat limited by street widths. Labor shortage and cost have forced the attention toward a study of machines designed specifically to handle snow. Until this winter there has been none developed beyond the "promise" stage, in spite of all the machinery which is available for handling other materials.



THE FRIEDMAN MACHINE HAS DONE SOME MARVELOUS WORK IN NEW YORK CITY

The intermittent periods of snowfall, the changing character of the snow and until recently the comparatively reasonable price of labor for manual handling have all tended to prevent experiment and expense necessary to develop the proper machine. Nevertheless, the company with which the writer is connected has spent about $7,000 upon the development of a snow-handling or loading machine which has so far failed to work with much success. It is believed that with the expenditure of several thousand dollars more the apparatus could be made to give results.

Meanwhile, the persevering Dr. Samuel Friedman of New York has developed, at his own expense and after about fourteen years of effort, a snow-loading machine which is successful to a marked degree. It will not only pick up all kinds of snow and load it into waiting trucks or cars but it will also handle ice in large chunks, after it has been loosened from the pavement and piled ahead of the path of the machine. The problem with Dr. Friedman's machine seems to be one of finding enough trucks to keep up with the loading capacity of the device.

Attempts to melt snow by means of asphalt surface heaters and other forms of apparatus depending upon heat in some form have failed dismally. The capacity is very limited and the cost unduly high. The cost for melting snow with such a device amounted to $7.33 per cubic yard and for melting ice ran up to $19.80 per cubic yard according to recent tests made in New York.

The use of sewers for snow removal and disposal has proceeded apace, so that today most large cities permit the railroad companies to use the sewer system to the greatest possible extent. The chief disadvantage often lies in the small capacity of the sewers in territory where there is most need for their use. In addition the manholes are soldom of a size which will permit of rapid disposal without much shoveling. There has been some development of special dumping manholes designed to overcome this trouble. These have so far taken the form of special openings in bridge floors.

Lack of sufficient flow or volume of sewage is also an occasional hindrance, but this can be remedied, first by flushing by means of fire hose with water from adjacent fire hydrants and second, as suggested by the New York Street Cleaning Commission, by providing special connections from hydrants to sewers underground, by means of which the needed additional flow may be more readily provided. In Brooklyn the use of the sewers has cut the cost of removal about in half through the elimination of the work-car haulage service. Some costs for various methods of snow removal in Brooklyn were given in the ELECTRIC RAILWAY JOURNAL for Feb. 21, 1920. In connection with the use of sewers, it will be found desirable to prepare small pocket maps showing the locations of available manholes, so that they may be found readily when covered with several feet of snow.

There have been practically no new developments in methods for opening up blockaded lines where service has been suspended. If the plows and sweepers have failed to keep them open there is nothing to do but "go at it" with pick and shovel. Fortunately, such blockades are becoming more and more rare. They are now most likely to occur through the occasional breakdown of equipment or derailment thereof, which prevents the frequent passage of snow-fighting apparatus over the line and allows time for the accumulation of snow and the formation of ice.

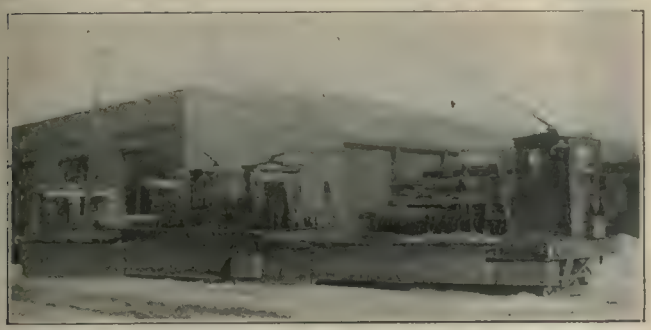
Motor Buses in New York State

At the close of the fiscal year ended Jan. 31, 1919, the Secretary of State revealed that in New York State there were 22,572 motor buses. In New York City alone there were 9,136. The number of buses registered in the State increased 24 per cent over the year 1918, an indication of their growing popularity for passenger traffic. The ratio of buses to the total number of pleasure vehicles in the State is approximately 5.05 per cent.

What is said to be the largest jet condenser yet built was recently completed by the Westinghouse Electric & Manufacturing Company, for the Alabama Power Company. It is capable of passing 13,000,000 lb. of water per hour.

Snow-Handling Practice East and West

Résumé of Methods Used on Various Systems Outlined from Answers to Recent Questionnaire



CHICAGO'S IMMENSE WING PLOW PROPELLED BY THREE WORK CARS



FRONT AND SIDE WING PLOWS ATTACHED TO SPRINKLER CAR IN CHICAGO

AS A RESULT of the severe storms of February last, many electric railway companies found themselves unprepared to cope with a storm of real magnitude and one which might reasonably be expected to occur during the course of any winter. While the effects of this storm, or series of storms, are still fresh in mind, many companies are casting about to see what steps may be taken as a safeguard against interruptions of a similar nature in the future. In this connection, and at the instance of R. C. Cram, author of the preceding article, a questionnaire was sent out to several electric railway companies to find out how they were prepared to deal with severe storms, and what methods they used to handle the snow after it had accumulated on the tracks. The questionnaire included seven questions as follows:

Some Questions as to Snow Removal Methods

1. In snow removal work, what other equipment do you use besides snowplows and sweepers?
2. What advantages either in reduction of cost or increased facilities of removal of snow have been obtained by use of sewer manholes for disposal?
3. Can you give any costs on a cubic yard or other basis of snow removal?
4. Have you developed any new or special apparatus for snow removal work? Have you used steam or electric shovels for loading snow? If so, what is the cost per cubic yard as compared with hand loading upon cars?
5. What are your obligations as to area of snow to be removed? Do you have any special arrangement with the city whereby you consolidate your obligation area into definite acreas, including the whole street between house lines in business districts, as an equivalent for your more unimportant outlying areas?
6. Do you contract for snow removal by carts, etc.? If so, what is the basis of payment?
7. Give an outline of your snow-removal program. How soon after snow begins to fall do you begin its removal?

Four of the replies received to the questionnaire give a resumé of the methods used on systems located in the East, Middle West and West.

In Denver in addition to the usual complement of snow plows and sweepers the Denver Tramway company uses work cars and autos to carry trackmen to salt the switches, and if the storm is so severe that operation has to cease, work cars and flat cars are used upon which to load the snow for removal from the streets. Wing boards are used on flat cars to push the snow farther away from the track.

When the snow is removed from the streets by flat cars, the special mechanical pusher built by the company and described in the issue of the ELECTRIC RAILWAY JOURNAL for May 10, 1919, page 924, is used. A few years ago, at the time of a heavy snowfall, three men with this pusher were able to perform the work which otherwise would have required a gang of fifteen shovelers. Flat cars containing from 10 to 14 cu.yd. of snow were loaded at an average rate of 6 min. per car. The pusher running day and night at a cost of $9 per shift for labor was able to unload more snow than was handled off flat cars by the city at Sixth Avenue with a cost of more than $80 per shift.

The Denver Tramway has no obligations or arrangements with the city in regard to snow removal, nor is any contract made with outside firms for this work. As soon as the snow begins to fall sweeper crews are ordered to report for duty. The removal work depends upon the weather conditions, the hour of day with reference to peak load, the kind and amount of snowfall, the time of year and the reports of car crews and inspectors as to whether or not the two-motor car lines are beginning to drag. In the event of a complete tie-up of traffic, due to an abnormal snowfall, the method of procedure is outlined in a standing order covering the work in detail. This standing order is corrected each fall to cover any changes in organization, routes, etc., which seem of value as a result of the experience of the preceding year. This organization work was outlined in an article in the ELECTRIC RAILWAY JOURNAL for Feb. 17, 1917, p. 304.

International Railway Has Agreement With City for Snow Removal

The snow-fighting equipment of the International Railway, Buffalo, N. Y., consists of sweepers, snowplows and rotaries, and only in case the line becomes blocked and it is impossible to open it up with any other equipment is shoveling resorted to. This company seldom removes any snow from the streets by carting away or otherwise, as an agreement for this work is in effect with the city, and the company is assessed a fixed portion of the cost. The railway company does, however, remove all snow from the tracks, in which work it is unassisted by the city.

The snow-fighting equipment is placed in operation very quickly after snow begins to fall and before 2 in. has actually accumulated.

In addition to its snow plows and sweepers, the Rochester lines of the New York State Railways use two snow-scraper cars and a car with an ice-cutting attachment, which cuts the ice and snow from between the rails. This company has an agreement with the city by which each pays 50 per cent of the cost of removing snow on streets where car tracks are located and each has a definite area to clean. The company removes the snow from the main street intersections in the center of the city and the city removes the snow between these intersections from curb to curb.

The New York State Railways do not contract for snow removal, but when necessary teams are sometimes hired by the day. Sewer manholes are used for the disposal of snow, and this method results in much shorter hauls. In some cases manholes are located at the spot where removal of snow is necessary, thereby decreasing the time of snow removal and reducing the cost of hauling.

The city of Rochester is mapped out in routes for the snow sweepers and plows to follow and these are classified as Routes 1, 2, 3, and so forth. This information is posted in each snow equipment for the information of the trainmen so that each crew will know just what streets to follow and clean, and it, in turn, reports back to the dispatcher's office by telephone at the end of each route or line. A record is kept in the dispatcher's office of each equipment location and of streets cleaned, so that at any time during the storm the superintendent and his assistants know where each sweeper and plow is located.

As soon as the equipment is called out, this depending on the density of fall, the location (city, suburban and interurban lines) and what amount of snow is previously on the ground, salters and switch cleaners are dispatched to the main sections of the city, while two trucks are loaded with salt and men are sent to the outskirts to clean and salt the switches. Each truck has its own route to cover. About twenty salt boxes are distributed at principal locations about the city where there is a large amount of special work.

The railway company has a private telephone dispatching system operated from a central office in the main office building with a telephone at the end of each car line and at other principal locations. This has proved invaluable in carrying out the snow-fighting program.

CHICAGO HAS IMMENSE WING PLOW PROPELLED BY THREE WORK CARS

The snow-fighting equipment of the Chicago Surface Lines consists of ninety-six sweepers, eleven power plows, eighty-one drag plows, forty-nine wing plows, and seven large sprinkler cars converted into wing plows. During the heavy snowfall of two years ago the heaviest drifts were successfully cleared from the tracks and from an area wide enough for other traffic outside the tracks by the use of an immense wing plow attached to a work car. Sufficient power to operate this equipment against the heavy drifts was derived by coupling three heavily motored and weighted work cars together. A signal system was connected between cabs so that all three motormen could simultaneously turn on their controllers. This combination appeared to be capable of moving anything, and it was these equipments which made it possible to cope with the unprecedented snowfall without suspension of service.

The practice in Chicago is to clean not only the 16-ft. area over the track, but also, by means of the various wing plows, to push the snow back toward the curbs in order to clear a roadway for trucks and automobiles. This is the only way such vehicles can be persuaded to stay off the tracks. The organization to handle this work is so perfected that upon occasion an army of employees can be called from their homes and put into action in less than an hour's time. Each man knows by prearranged plan just where he is to report and what he is to do if he is called and given the command "snow." The men are fed on the job by the



HEAVY WORK FOR THE SWEEPER ON THE SAULT STE. MARIE TRACTION LINES

company, so that there is no stopping of the snow-fighting work through desertion in search of food and warmth.

A liberal use of salt at all switches and special work locations at the beginning of a storm is considered one of the secrets of keeping the cars moving. A very close contact with the Weather Department is another, serving as it does as a means of anticipating what preparations may be necessary.

The Efficiency Mileometer*

This Device Records the Difference Between Power-On and Power-Off Privilege, as Well as Total Mileage

BY C. H. KOEHLER
Efficiency Mileage Recorder Company, Louisville, Ky.

THERE has always been a need for a mileage recorder for electric railway cars. Nearly all important statistics of operation in the electric railway industry depend upon the mileage factor for their significance. Revenue, power, life of equipment and maintenance are all determined on a car-mile basis. A speedometer and odometer is considered standard equipment for practically every gasoline-propelled vehicle manufactured today. The need of a mileage recorder for the electric railway car, which covers yearly from 30,000 to 50,000 miles, and represents a far greater investment than the average gasoline car, seems even more logical.

The railway property of today estimates its mileage from dispatcher's train sheets or from conductor's way bills or trip sheets. This work is done by clerks, with resultant clerical errors and attendant clerical expense. Particularly on city properties this mileage is both difficult and expensive to obtain accurately. Where individual car-mileage records are kept, as for inspection purposes and the like, this work becomes even more expensive and less accurate. The advantage and saving in clerical expense of a mileage recorder that automatically corrects for turn-backs, pull-ins and other lost or additional mileage are apparent.

In the past, mileage recorders of two types, mechanically driven and electrically operated, have been tried out. Mechanically operated mileage recorders of almost every conceivable design have been applied to electric railway cars, with generally unsuccessful results. The severe service to which a car is subjected and the fact that a considerable length of flexible shafting is needed properly to locate the register have rendered the everyday speedometer and odometer unadaptable.

As far back as 1900, J. R. Cravath was granted a patent on an electrically operated wheel-revolution counter. Probably due to the fact that in those days electrical contact mechanisms had not been developed to the state they are at present, no commercially successful device resulted.

However, in recent years the cam-actuated electrical contact has been developed to a high degree by manufacturers of magnetos and ignition apparatus. Electrical counting mechanisms and relays have also been used as standard apparatus by many industries with satisfactory results. The application of modern magneto and ignition practice and of modern telephone and telegraph practice have resulted in the development of a simple and satisfactory electrically operated mileage recorder, or "efficiency mileometer," as it is called, which will be briefly described.

Instead of merely registering total mileage, both total mileage and "power-off" or "coasting" mileage are registered, thus giving means of determining the motorman's car-operation efficiency. Even the layman realizes that the more miles a car coasts or runs with power shut off the less power is used. This relation between per cent coasting mileage and the kilowatt-hour consumption per car-mile has been proved by extensive tests. In fact, it is possible, after a characteristic curve for a given type of car has been plotted, accurately to determine the energy used per car-mile from the per cent coasting mileage. Another important feature of the device is the efficiency indicator, which tells the motorman at a glance what his operating efficiency is, just as a speedometer tells at a glance the speed.

The complete efficiency mileometer consists of three units—the circuit maker, the register and the resistance box. The circuit maker is an iron-clad make-and-break cam-operated contact device, somewhat similar in operation to a magneto interrupter. It is fastened to the end of the journal in the journal box, and makes one contact per wheel revolution. It is accessible and easily replaced, and interferes in no manner with the packing or removal of the brasses. Due to the use of a wipe type of contact, oil does not affect its operation. Tests over a six months' period tend to bear out the claim that it needs attention only every 40,000 or 50,000 miles, or about yearly, and then only for cleaning. Since the device "floats," secures plenty of lubrication and operates at relatively low speed (300 r.p.m. maximum for city cars), there is practically no mechanical wear.

CONSTRUCTION AND OPERATING DETAILS

The register consists of a magnet coil in series with the circuit maker, actuating the mileage counter and efficiency indicator through a driving pawl, ratchet and train of gears. An electro-magnetic brake operates a planetary transmission, throwing the coasting register out of gear when power is applied. The main or counting magnet coil operates on 30 volts and 0.06 amp., or about 2 watts, by means of a scheme of bridging resistances. There are no high-potential wires in either the register or circuit maker, as the voltage of 600 is mainly impressed on the two enameled resistors comprising the resistance box. There is only one contact in the entire system. The efficiency indicator is merely a lettered wheel rotating in one direction for power-on miles, and in the opposite direction for power-off miles. The cumulative sum of the power-on and power-off miles puts a good man in class AA or A. A poor man, unless he coasts over 50 per cent of the total miles, is always in class C or D.

Voltage variation in no way affects the accuracy of registration. The circuit maker can be timed accurately to register on either an interurban car operating at 90 m.p.h., or a city car at 25 m.p.h., with voltage varying from 600 to 250.

Errors due to wheel diameter variation are corrected for in the following manner: For use on say a 34-in. wheel, the efficiency mileometer is calibrated to read correctly in miles on the average diameter through the life of the wheel, or approximately 32.5 in. For the individual car, when the wheel is new, the mileage records will be approximately 96 per cent of the true mileage, while on an old wheel of 31 in., the records will be approximately 105 per cent of the true mileage. The

*Abstract of discussion of paper by D. D. Ewing, read before Central Electric Railway Association at Louisville, Ky., March 11, 1920, by W. Shaw for the author.

aggregate average wheel diameter of any ten cars with normally new 34-in. wheels will be very near to 32.5 in. Thus the law of averages on a number of cars, or even on one car for say 40,000 or 50,000 miles, eliminates the error due to wheel diameter. Where a system is equipped, corrections for wheel-diameters can thus be neglected.

The per cent coasting-mileage figure is unaffected by wheel diameter variations, as the same error is present in both numerator and denominator.

Wheel slippage has been found to be a negligible factor. In fact, the efficiency mileometer inherently discourages wheel slippage. Wheel slippage means more power-miles. Locking of wheels or skidding in braking is also discouraged, since wheel skidding means less coasting mileage.

SUMMARY OF ADVANTAGES

Summing up, the advantages of the efficiency mileometer might be listed as follows: (1) It gives accurate records. (2) It records the complete efficiency ratio, both numerator and denominator. (3) It tells the motorman at a glance, by means of the efficiency indicator, his class of operating efficiency. (4) It gives a coasting percentage figure that can be used without additional calculation, to determine the slack in schedules. (5) It gives a coasting percentage figure that can, by means of a characteristic curve for given equipment, be used accurately to determine the energy consumption per car-mile.

Claim Records in San Francisco

THE San Francisco Municipal Railway has made public the following figures of its claim department for the years ended Dec. 31, 1918 and 1919:

(GENERAL STATISTICS)

	1919	1918
Total passengers carried during the year	63,966,470	55,994,844
Car-miles operated (cars 7,122,005, buses 260,324)	7,382,329	7,070,359 63
Number of passengers to mile	9	8
Number of accident reports filed*	1,916	2,172
Number of accidents fatal	9	10
Number of accidents—personal injuries	656	754
Number of claims presented	431	487
Number of claims adjusted	125	114
Number of suits instituted	23	12
Number of suits pending	42	22
Number of passengers carried per accident report	33,334	25,7 0
Number of passengers carried per personal injury report	97,510	74,2o4
Number of passengers carried per fatal accident	7,107,385	5,599,484
Number of fatal accidents to passengers	4	None

CLASSIFICATION

Car collisions	123	206
Auto and wagon collisions	1,134	1,128
Boarding moving car	156	195
Leaving moving car	111	120
Miscellaneous	392	523
Total	1,916	2,172

	1919	1918
Percentage of accidents to passengers carried	0 000029	0 000039
Total receipts	$2,646,682 81	$2,232,000 29
Total amount paid accident claims, office and miscellaneous expense	32,655 40	28,997 15
Ratio to operating revenue	0 0123	0 0129

* "Number of accident reports filed" also includes reports of accident shappening near the cars in which the railway was not involved.

RECAPITULATION OF AMOUNTS PAID IN 1919

Personal damages	$18,739 58
Property damages	3,766 00
Expenses of office in adjustment of claims	10,149.82
Total	$32,655 40

RECAPITULATION OF AMOUNTS PAID IN 1918

69 Personal damages	$26,771 15
21 Automobile damages	1,759 50
3 Wagons and vehicles	21 00
13 Damaged wearing apparel	124 35
1 Miscellaneous	320 25
Total	$28,997 15

Automatic Train Control Discussed

Problem Is to Increase Rather Than to Sacrifice Track Capacity

AT A meeting of the New York Railroad Club held on Friday, March 19, the subject of discussion was "The Automatic Train-Control Problem." A paper on this subject was presented by H. S. Balliet, signal engineer electric division New York Central Railroad. Some of the salient points in the paper were as follows:

The earliest record of an effort to undertake communication with moving trains dates back to 1859. Since that time there have been several experiments but, as the automatic airbrake was not invented until 1872, the use of automatic train-control devices in connection with the brake system was not possible until after that date. There are at the present time seventeen devices for this purpose, comprising five types of automatic train control.

It is not difficult to apply devices to stop a train, but if this only is done track is sacrificed. Automatic train control with speed control must maintain existing operating requirements and, if possible, increase track capacity. Very little progress has been made in meeting the requirements of speed control.

The development of automatic train-control devices and their use to supplement existing automatic block signals are highly desirable. The apparatus must be suitable to operate efficiently on trains at the highest permissible speed and must bring the train safely to a stop without endangering the controlled train or trains on adjacent tracks. Such automatic control devices must be expected to prevent only such accidents as are due to the failure of employees to observe, understand and obey signal indications.

The automatic train-control problem is to provide an appliance which will furnish protection against accidents when employees disregard signal indications or when signals improperly indicate "proceed." The two general classes of control devices are "contact" and "non-contact." The former depends for its operation on the physical contact of an element carried on the train with an element at a fixed location on the roadside. The second depends for its operation on electrical or magnetic impulse without physical contact between the roadside and train elements. There are many important factors entering into this problem such as reliability in operation; inspection, maintenance and tests to insure efficiency; clearance; capacity; interchangeability as between different devices on track used by railroads jointly and co-relation with track-circuit controlled block signaling and airbrake apparatus.

The cost of an automatic train-control system is an undetermined item involving not only the original expense of installation, but also the cost of maintenance and the effect of its operation on the capacity of existing facilities.

The special Libraries Association is taking a census of the special library collections of the country. Information is wanted of all special libraries, subjects covered, name of owner and of librarian, and clientele served. It should be sent to W. F. Jacob, Chairman Library Census Committee, General Electric Company, Schenectady, N. Y., who will be glad to answer any questions relating thereto.

Economical Use of Energy for Car Purposes*

The Author Analyzes the Ways in Which Energy Is Consumed on the Car and Suggests Ways in Which the Consumption Can Be Reduced

BY D. D. EWING
Professor of Electric Railway Engineering, Purdue University, Lafayette, Ind.

ACCORDING to the 1917 report of the Bureau of the Census electric railways were then generating seven and a quarter billion kilowatt-hours of electrical energy and purchasing an additional five billion annually. If, of this total, 80 per cent is used for traction purposes then ten billion kilowatt-hours are used in moving our cars to the extent of two and one-eighth million car-miles. This is an average energy consumption of 4¾ kw.hr. per car-mile measured at the power-plant switchboard. At 3½ lb. of coal per kilowatt-hour the total consumption is seventeen and one-half million tons or about 3½ per cent of the annual coal production. If, by the proper selection of equipment and by the proper operation of this after it is selected, it would be possible to cut the coal consumption in half, the saving at $3 per ton would be $26,250,000 per year. Of the 4¾ kw.hr. only about 60 per cent gets to the cars, the balance being "lost in transit." Possibly the transmission losses are as important as those on the cars, especially since it is easier to control the former than the latter.

On the car energy is lost in the friction between trolley wheels and trolley wires, in the friction at the wheel bearing, in the arcing at the wheel wire contact, in the resistance of both the wheel wire and harp wheel contact, and greatest of all, in the main motor circuits. Certain losses occur in the motors themselves, the starting resistance grids take a part, the gears too take their toll, passing on the balance in the form of mechanical energy to the car itself. Another set of circuits, namely, those supplying energy for lamps, heaters, compressors, etc., also add to the energy consumption.

When a man really wants to save money he keeps books; he lists his income and outgo and then analyzes the account. In the accompanying tables are some accounts with the "power bank" for three types of cars. In table I the data for the interurban and the 14-ton city cars are for the most part from actual tests, the segregation of the energy supplied to the main motor circuits, only, being estimated. The figures for the Birney car were estimated. The data were all taken during cold weather, and the lights were on about one-half the time. Carbon lamps were used in the two cars tested, and Mazda lamps were figured on in the Birney car data. The schedule speed for the interurban was 24 m.p.h., and the stops were at the rate of one every two miles. For the other cars the figures are for six stops per mile and a schedule speed of 9 m.p.h. It is understood that the energy and power requirements of electric cars depend upon many different factors, but the data here presented are sufficiently representative for the purpose of the present discussion.

As indicative of the power supply to different parts of a car, while it is operating at balancing speed on straight level track, the data in table II are presented. The figures are for the same cars, and were arrived at in the same manner as those in table I. The figures apply for the conditions prevailing when all circuits are energized.

Some of the figures in table I look small, but a better appreciation of their significance arises when one remembers that the work which a kilowatt-hour will do is equivalent to raising a ton to a height of one-fourth mile.

MAIN-MOTOR-CIRCUIT ENERGY CONSUMPTION

The tabulated values show that the percentages of energy used in the main motor circuits range from 60 to 95. The items which make up this part of the car's energy consumption are interdependent, a change in one affecting the others. As a general proposition savings may be effected by using improved equipment, by improved operation, or by a combination of both.

As a rule, economical car operation involves (1) rapid acceleration, (2) high braking rate, (3) high coasting percentages, (4) short stops and (5) few stops per mile. These factors may in some cases be incompatible with traffic requirements. The first three are at least partly within the control of the motorman. The duration of stop is partly within the control of the car crew, is partly dependent upon the design of the car and is largely dependent upon the character of the traffic. The number of stops per mile is fixed either by legal or traffic requirements and is largely beyond control.

The energy required for car propulsion, as shown by table I, ranges from 40 to 66 per cent of the total. On some roads the energy required to pull the cars up hills constitutes an important element. The amount required can be reduced by eliminating grades and reducing weight of cars. Curve resistance is not ordinarily an important energy consumer, but on the average road a reduction of 50 per cent in energy consumption due to this item seems possible through control of track curvature, super-elevation of outer rail, shape of rail head and wheel contour, weight of car, and state of maintenance of cars and track structures.

Rolling friction is a minimum with a well-aligned and firm yet elastic roadway. Railhead and wheel-tread shapes and car weights affect it. The energy consumption due to this item could probably be cut in half by proper way construction and maintenance and by the use of cars of lighter weight. Bearing friction also depends on the weight of the car, the kind of lubricant and the method of lubrication. Anti-friction bearings will reduce this friction to a very low figure.

Air resistance, as shown in table II, is important only at the highest speed. Care in designing body shape should result in a reduction of the energy consumption in overcoming this resistance.

Some brake loss is necessary to secure proper car control, and it is a loss partly within the control of the car crew. On many roads it is excessive even where

*Abstract of paper read at annual meeting of the Central Electric Railway Association, Louisville, Ky., March 11, 1920.

TABLE I—SEGREGATION OF ENERGY CONSUMPTION IN DIFFERENT ITEMS OF CAR OPERATION

(a) Interurban Car Weight 40 tons.

Item	Kilowatt-Hour per car mile		Percentages	
Car propulsion	1.865		66.2	
Motor losses	0 396		14.1	
Grid losses	0 259		9.2	
Gear losses	0.070		2.5	
Total, main motor circuit		2.590		92 0
Headlight	0 070		2.5	
Car lights	0.079		2.8	
Air compressor	0.031		1.1	
Control circuit	0 030		1 0	
Total, auxiliary circuits		0.210		7.4
Trolley wheel losses		0 017		0.6
Grand total		2 817		100.0

(b) Single Truck City Car. Weight 14 Tons.

Item	Kilowatt-Hour per car-mile		Percentages	
Car propulsion	1.402		48.5	
Motor losses	0.262		9.0	
Grid losses	0 438		15 0	
Gear losses	0 087		3 0	
Total, main motor circuit		2.190		75.5
Heaters	0 666		1.3	
Lights	0 033		1 2	
Total, auxiliary circuit		0.699		24.2
Trolley wheel losses		0.010		0 3
Grand total		2.933		100 0

(c) Birney Car. Weight 7½ tons.

Item	Kilowatt-Hour per car-mile		Percentages	
Car propulsion	0.80		40.6	
Motor losses	0.15		7.6	
Grid losses	0.25		12.7	
Gear losses	0.05		2.5	
Total, main motor circuit		1.25		63.5
Heaters	0.666		33.8	
Lights	0.015		0.7	
Air compressor	0 030		1.5	
Total, auxiliary circuits		0.711		35.0
Trolley wheel losses		0.010		0.5
Grand Total		1.971		100.0

TABLE II—ANALYSIS OF POWER CONSUMPTION IN SEVERAL TYPES OF CARS

(a) Interurban Car. Weight 40 Tons.

Item	Kilowatts		Percentages	
Rolling and bearing friction	37 6		26.7	
Air resistance	60 0		42.5	
Motor losses	30 5		21.7	
Gear losses	3.9		2.7	
Total, main motor circuit		132.0		93 5
Headlight	2 6		1.9	
Car lights	1 0		0.7	
Air compressor	4.5		3.2	
Control circuit	0.3		0.2	
Total, auxiliary circuits		8.4		6 0
Trolley wheel losses		0.7		0.5
Grand total		141.1		100.0

(b) Single Truck City Car. Weight 14 Tons.

Item	Kilowatts		Percentages	
Rolling and bearing friction	7 8		32.1	
Air resistance	3.4		14 0	
Motor losses	4 8		19.7	
Gear losses	1 5		1.0	
Total, main motor circuits		17.5		72 0
Heaters	6 0		24.8	
Lights	0 6		2.5	
Total, auxiliary circuits		6 6		27.3
Trolley wheel losses		0.16		0 7
Grand Total		24.26		100 0

(c) Birney Car. Weight 7½ Tons.

Item	Kilowatts		Percentages	
Rolling and bearing friction	4.2		19.2	
Air resistance	2 7		12.3	
Motor losses	4.6		21.0	
Gear losses	1.0		4.5	
Total, main motor circuit		12 5		57.0
Heaters	6 0		27.4	
Headlight	0 3		1 4	
Air compressor	3 0		13.7	
Total, auxiliary circuits		9 3		42 5
Trolley wheel losses		0 121		0.5
Grand Total		21 92		100.0

the brakeshoes are properly adjusted and maintained. Stopping a 40-ton car from a speed of 50 m.p.h. at the rate of 2 m.p.h.p.s. by means of the brakes requires an energy consumption by the brakes of about 2.2 kw.-hr. This loss is decreased by increasing the amount of coasting, while regenerative braking offers some possibilities but as yet has not been worked out in a form practicable for street cars.

Motor losses are dependent upon the design of the motor, the size of the motor (and therefore indirectly upon the weight of the car), the motor speed, the gear ratio, and the operating methods and conditions. As a general rule these losses are reduced by reducing the car weights, increasing the coasting and using slow-speed motors geared to minimum reduction. The motor losses for the Birney car as given in table I could be decreased not to exceed 10 per cent. A greater reduction is possible for the other cars. These reductions are predicated on a decrease in car weight and the proper application of the motor and control equipment. In some cases the reduction might amount to not less than 30 per cent.

Grid loss is always an important loss in city service. It is affected by operating methods and conditions and motor and control design. On the average road this loss could be very likely reduced 50 per cent by proper operation and the use of properly applied motors and control systems.

Gear loss is never a very large item if the gears are well maintained. Except as it is affected by reduction of car weight, there is possibility of but little reduction in the energy consumption of this item, at least not until the time comes when herringbone gears running in oil can be used.

The data in table I indicate that from 5 to 40 per cent of the energy consumption of a car may occur in what might be called the "frills of the car." In light-weight cars it is especially important that the consumption in these circuits be kept low. A few suggestions along this line are given below.

Heater loss depends on the climate, type of car and method of heater control, as well as upon the number of passengers in the car. Between four and five watt-hours per cubic foot of car volume will be required in a lightly loaded car. As ten persons radiate about as much heat as a 1-kw. heater, the amount necessary on a loaded car is less. Thermostatic control of the heater would seem to be the best reducing agency here, savings ranging from 15 to 40 per cent of the energy required for heating having been reported. A possibility that offers much promise is the utilization of the heat dissipated in the grids. For average winter conditions this grid loss on the heavier city cars now in service is but slightly less than the heater requirements.

The use of Mazda lamps for the interior lighting and the headlight reduces considerably the energy required for this purpose, as compared with the use of carbon lamps and arc headlights.

The air compressor runs intermittently, and its energy requirements depend on operating conditions and methods and upon the mechanical condition of the compressor and pressure piping system. A slight leak in the piping may easily double the energy consumption of the compressor, as may also careless handling of the brakes and other air-using devices.

Cars equipped with remote control require a certain amount of energy for the operation of the switch

groups. In some of the modern electro-pneumatic control systems the energy required directly for control operation is only about 20 per cent of that in some of the earlier systems. The demand on the air compressors, however, is increased. A decrease in the time that power is used for propulsion purposes decreases this loss in direct proportion. The loss at its worst, however, is a small one.

Trolley fed signals also require a small amount of energy, but there is little reduction in consumption possible with well designed circuits.

CURRENT-COLLECTING DEVICES

The amount of energy lost at the trolley wheel is small and is of interest chiefly because it is, to a certain extent, a measure of the life of the wheel and wire. Recent tests show that for a city car collecting 50 amp. at 20 m.p.h. with 20 lb. trolley tension, the mechanical loss due to the wheel wire and rotation section is about 30 watts; the electrical loss at the wheel-wire contact, 110 watts, and the electrical loss at the bushing contact, 20 watts. The aggregate is 160 watts. For an interurban car collecting 200 amp. at 50 m.p.h. with 30 lb. trolley tension, the losses are about as follows: mechanical, 110 watts; electrical, at wheel wire contact, 400 watts; electrical, at bushing, 180 watts; total, 690 watts.

Briefly summarized, the greatest possibilities in the way of energy saving lie in the use of lighter cars, of proper operating methods and of equipment properly applied to the service which it is to perform. If these possibilities were used to their fullest extent on all the railways of the country, I firmly believe that while we might not be able to save the 50 per cent of the coal mentioned in the introduction to this paper, we should be able to save at least 50 per cent of the 50 per cent now charged against the cars. We should not attempt to save electrical energy at the expense of something else more costly, as such saving is likely to prove to be "saving at the spigot, while wasting at the bung." A saving to be justified must be one considered from the standpoint of the business as a whole. It never pays to spend $10 in one department to save 10 cents in another.

Track Swings Simplified

By Use of Simple Formula, Track Swings Can Be Properly Constructed by Any Foreman

BY W. T. ROSSELL
Superintendent Track and Buildings, South Covington & Cincinnati Street Railway, Covington, Ky.

IT IS often necessary, for the sake of car clearance or in order to meet old work, to swing track to a parallel line. The offset may vary from a fraction of an inch to one or more feet and the length of this reverse curve is often left to the judgment of the assistant engineer or even the foreman. This means that at one point the length of the swing may be 20 ft. and at another 30 ft. for the same offset distance. Often paving must be removed and replaced. The swing should be of ample length to secure easy curves and yet should not be one foot too long. There is no reason why the swing should not be standardized. The complete form is a curve, a short tangent and a curve as shown in an accompanying illustration.

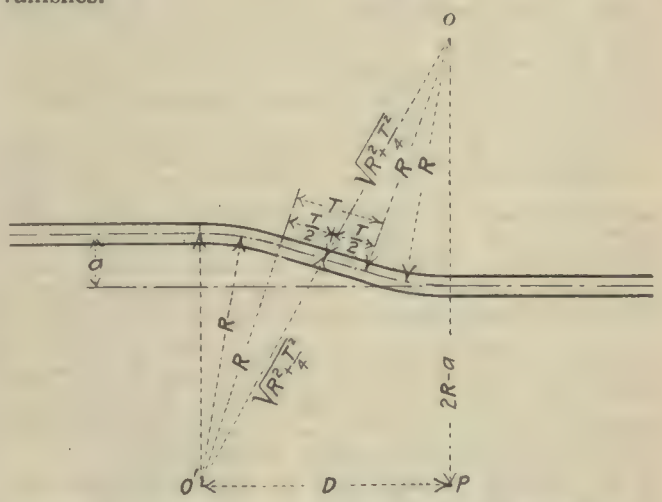
In order to determine all of the functions of this swing with certain conditions fixed or values known, referring to the illustration:

Let a = Offset, center line
R = Radius of curves
T = Tangent between curves
D = Over-all length of swing.

Connect the centers of the curves OO'
Draw OP perpendicular to and $O'P$ parallel to the center line of the track.
Then the solution is evident from the right triangle OPO'

$$D^2 = \left(2\sqrt{R^2 + \frac{T^2}{4}}\right)^2 - (2R - a)^2$$
$$D^2 = 4R^2 + T^2 + 4R^2 - 4aR - a^2$$
$$D^2 = T^2 + 4aR - a^2$$
$$D = \sqrt{T^2 + 4aR - a^2}$$

Standard values may be selected for T and R and the equation solved for D. If desired T is made zero and vanishes.



ASSUME VALUES FOR T, R AND A, AND SOLVE FOR D

Below is shown a table with T equal to 25 ft., R equal to 500, 1,000, 1,500 and 2,000 ft. respectively and a varying from 1 in. to 3 ft. Intermediate values are interpolated.

$$D = \sqrt{T^2 - 4aR - a^2}$$

R / a (inches)	500 feet D (feet)	1,000 feet D (feet)	1,500 feet D (feet)	2,000 feet D (feet)
1	28.1	30.9	33.6	35.9
2	30.9	35.9	40.3	44.3
3	33.6	40.3	46.1	51.2
4	35.9	44.3	51.2	57.4
5	38.2	47.9	55.9	62.9
6	40.3	51.2	60.2	68.0
7	42.3	54.4	64.2	72 8
8	44.3	57.4	68.0	77.2
9	46.1	60.2	71.6	81.4
10	47.9	62.9	75.0	85.4
11	49.6	65.5	78.3	89.2
12	51.2	68.0	81.4	92.9
15	55.9	75.0	90.1	103.0
18	60.2	81.4	98.1	112.4
21	64.2	87.3	105.4	120.9
24	68.0	92 9	112.4	128.9
30	75.0	103.0	125 0	143.6
36	81.4	112.4	136.5	156.9

It is difficult to make many foremen place the tangent between the two curves. However, when once they see it properly laid out they are so well pleased with the appearance that they take pride in always doing it right.

A newspaper dispatch from Chamonix, Switzerland, states that French and Italian engineers are making preliminary studies for a tunnel under Mont Blanc, which will give a direct connection between France and Italy.

How Meters Induce Car-Energy Savings*

In Discussing the Paper by D. D. Ewing, the Author Elaborates That Phase of the Subject Which Relates to the Province of the Motorman

BY L. E. GOULD
President Economy Electric Devices Company, Chicago

PROFESSOR Ewing has presented an able analysis of the car-energy consumption factors and has shown the proportionate subdivisions of each unit of energy used, not only in useful work but in the various losses between the trolley wheel and the rail. A similar analysis should be found to be most helpful when studying how car propulsion energy can be conserved. Such a study should have for its objective the determination of those losses which can, through better engineering practice and better operating practice, be made to net the largest consistent savings with the least outlay and least hazard. That, perhaps, is a rough definition of our subject, "economy."

Professor Ewing's paper points out that, generally speaking, energy savings may be effected by use of improved equipment, by improved operation or by a combination of the two. My discussion will relate largely to what I think Professor Ewing means by the words "improved operation." For example, consider that road which has paid much attention to effecting economies in power generation, distribution and the return circuit. Likewise it has highly efficient motive-power equipment on cars of consistent weight operated on carefully planned schedules. A road so equipped still affords full opportunity for conservation of car energy.

Substantial savings can be made through better handling of the controller and brakes; that is, through training the men to have in mind conservation of energy in addition to safety and service. And the road with the most highly trained men can still show a very worth-while economy in energy consumption if it will give its motormen an energy-checking device for use as a tool to help them to keep check on their individual improvement.

It is true that motormen are taught to handle their trains most efficiently, and on many roads this part of their service is regularly supervised. Yet we have learned by tests on many properties and by actual installations on nearly fifty roads in the United States that the use of an energy-metering device will so improve the saving accomplished that sufficient net savings are available to wipe off the cost of the installation of the device early in the first year of its use.

The average well-meaning motorman who runs on schedule, but who wastes energy, does this simply because he does not understand how to utilize car energy efficiently; or, perhaps more specifically, because there is no stimulus for him to keep "on his toes" all the time. So far as power saving goes he has no incentive for operating economically. But give this man a power-saving device which will show him how much energy his car uses for his run, for a trip, for a part of a trip, or even for as small an amount as the energy consumed in climbing a long grade, and the motorman's interest immediately is stimulated to more efficient operation. Then follow substantial energy savings and many other worth-while economies.

With a watt-hour meter on his car the motorman can actually determine for himself some of the important factors set forth in Professor Ewing's paper. He can see just how much saving he makes by proper acceleration. He can see that coasting normally will save energy, and that fanning the air brakes wastes energy. With a meter on his car the motorman can see the power-consuming effect of unnecessary stops and slowdowns when climbing grades, and he can note from watching his meter the relative amount of energy that is being taken when operating on series, on the resistance notches and at free running or balancing speed. In other words, the kilowatt-hour meter on the car gives the motorman, and oftentimes the management, a new view of car operation and therefore increases interest in the work.

The motorman has faith in his meter because, through its open face and its easily read and understandable dials, he can prove to himself which method of operation gives him a low record and which a high record in energy consumption. This is the psychology underlying the success which the Economy meter has had in obtaining sustained records of low energy consumption.

Briefly, the Economy meter is a simple, rugged, energy-measuring device, designed particularly for use on electric railway passenger and freight cars and locomotives. It shows the motorman and the management in clear figures the actual car energy consumption. It is usually connected to measure only the energy consumed in the car motor circuit. It checks the performance of motormen and, in addition, is a constant inspector of the condition of the equipment. It gives all the power-saving results obtainable with other checking devices and in addition affords engineering data of high value.

The watt-hour meter functions while energy is being used, and its rate of functioning is in proportion to the product of the amperes and volts in the circuit at any instant. It registers the actual energy consumption, no matter what operating conditions may be encountered. It is the only rating device which actually and directly compares men on the basis of their relative energy consumption. A motorman may ascertain at any time what progress he is making just as easily as he can read the mileage recorder on an automobile.

The meter checks the motorman directly in terms of the unit he is asked to save; namely, the kilowatt-hour. If an instructor tells an inefficient motorman to operate this way or that way in order to reduce his power consumption, the motorman is inspired with more confidence when he actually tries his own way and then the instructor's way and, by means of the immediate infor-

*Abstract of discussion of paper read by D. D. Ewing at annual meeting of Central Electric Railway Association, Louisville, Ky., March 11, 1920

mation which the meter gives, finds out that the instructor's way actually does require less energy.

The so-called "power-saving devices" are all monitors to show the management whether the motormen have operated their cars efficiently. These devices stimulate correct operation and thus lower energy consumption, but only to the extent that motormen believe they are being rated and compared fairly. Sustained energy saving will be highest with that device which, under all conditions of operation, most fairly rates the relative operating efficiencies of motormen.

What Can Be Accomplished by Metering the Car Energy

The Economy meter measures a man directly in power units. A motorman is asked to save energy and, when rated by a watt-hour meter, he knows absolutely—trip by trip—whether or not his efforts result in actual reductions in energy consumption. With no other devices does the motorman know directly whether power has been saved or wasted. Metering the energy properly credits a man for taking advantage of every opportunity to save power.

One of the simple ways to stimulate energy-saving efforts is to post the number of kilowatt-hours required by the average man for a round trip on a given line. This is a bogie for all men to work against and the meter will plainly show any man how much energy his car has actually consumed as compared with the average trip of the average man.

In considering, for power-saving purposes, the use of the watt-hour meter as compared with devices which measure a time element and not energy consumption, there are several important factors that should be noted carefully.

First, the meter neither introduces a hazard into car operation nor puts any premium on any practice which is contrary to safety first.

Second, the kilowatt-hour is the only unit which gives a motorman full credit for all that he may do to reduce energy consumption while keeping his car on schedule.

Third, the meter gives a motorman credit for consistently fast, smooth feeding, but does not put a premium on so-called "cannon ball" acceleration.

In 1915 J. F. Layng of the General Electric Company presented energy consumption curves which showed the influence of various factors, such as number and length of stops and rates of feeding and braking on the watt-hours per ton-mile for typical cars in typical service. The energy curves for acceleration and retardation have about the same shape. They show that faster feeding and faster braking, up to a certain good rate, will bring about a substantial reduction in energy consumption, but feeding or braking beyond this rate does not proportionately reduce the energy consumption. It does, however, shorten the power-on time and consequently increase the possible coasting time. But these quantities have not the same value in equivalent energy reduction as they have in the parts of the curve represented by slower feeding and braking.

When watt-hour meters are used to measure power savings on the cars, the motormen get credit for pausing on the full series notch if the condition of operation is such that a pause will save energy. Measuring only the time of power on, brakes on, or coasting, puts a heavy penalty on pausing on the full-series notch.

The meter gives due credit for running on full series in congested districts or, with an interurban car, over slow-speed track, such as through small towns. F. E. Wynne, Westinghouse Electric & Manufacturing Company, has shown speed-time and current curves for a quarter-mile run with an interurban car with the controller on series, as compared with full multiple operation and more coasting. Both running times were the same. Mr. Wynne's study showed that series running under slow-speed requirements meant a saving in the case cited of 18.25 per cent in energy consumption.

Any motorman who has operated a car equipped with an Economy meter will tell you that on slow-order track he can keep his car on time and save considerable energy by running on full series rather than on multiple and coasting. In a test recently conducted on a fifty-car line in Chicago one motorman who had made an extremely low power record for the day, when asked how he operated in order to get such a good record, replied, "By feeding up my controller quickly, by coasting a lot in the outlying sections, and by considerable series running downtown where it's crowded."

A large number of roads in the British Isles—even more than 75 per cent—have their cars equipped with meters and therefore the power-saving instructions, based on many years of experience, are of particular interest. Note this rule of the Aberdeen Corporation Tramways:

> Get off the resistance notches, as quickly as possible without rushing the notches, onto full series or parallel. Never run on parallel unless you can take full advantage of the last notch. It is simply wasting power to throw off on the first or second parallel notches. The resistances have used up the most of it; the motors have only gotten a fraction of the power consumed. The same work could have been done with series at half the cost.

Meters give motormen full credit for operating on full series and on full multiple position. They penalize them for running on resistance notches.

No interurban road can boast of never having low voltage, and necessarily this condition should be taken into consideration in the choice of a power-saving device. Low voltage will materially increase the power-on time if a car or train is to be kept on schedule. And the lengthened power-on time directly lowers a man's rating, through no fault of his own, if he is rated by a power-saving time device. A watt-hour meter measures the actual energy consumption at the lower voltage, and this is not materially greater than at normal voltage—what increase there is being due to the slightly decreased efficiency at which the motor operates on low voltage. Therefore, when line voltage is low the watt-hour meter assures a motorman a fairer standing when compared with other men who did not operate under low voltage conditions.

By-Product Savings of the Meter

Referring to Professor Ewing's mention of equipment savings, there are, in addition to a direct reduction in energy consumption, numerous other economies which follow the installation of watt-hour meters on cars and locomotives. For example, if rehabilitation is in order, the sum of the meter readings averaged for any comparative period will assist in the determination of the most efficient types of equipment. For instance, one large user of Economy meters was able, through a change in wheel size, to reduce the average consumption of a substantial number of cars from 123 to 105 watt-hours per ton-mile. Without meters this possible economy could not easily have been discovered.

Meter readings will show the relative power cost for

giving service with different combinations of train make-up. The Chicago, North Shore & Milwaukee Railroad has every motor car equipped with a meter. This road operates every variety of train, from safety cars to heavy five-car, high-speed trains, each car equipped with four 160-hp. motors. The meter records readily show the actual power cost of operating each type of train—a substantial advantage when rearranging schedules and service.

All power-saving devices bring about a reduction in brakeshoe and wheel wear; and because less energy is used there is also a substantial reduction in the roasting of coils and grids.

With watt-hour meters on cars both the transportation and the mechanical departments can at once realize the high cost of binding brakes, tight side and center bearings, nosing trucks and similar defects which come about from natural causes and which should have prompt repair. Often, however, for various reasons, such repairs are deferred. But when their cost is directly shown by the high energy consumption which they bring about, there is a natural tendency to make repairs, and it is easy to justify expenditures with which to do so promptly. In other words, the use of the car-energy meters serves as a strong influence to keep defective cars off the line, and this in itself will result in a substantial power saving.

Economy on the car itself and long life to the electrical equipment, as well as good service, demand a good average line voltage. Therefore, the amount of loss between the substation direct-current feeder switch and the car motors is a most interesting subject for study. On several tests conducted during the past two years we have been able to obtain accurate readings of the direct-current send-out and compare these with the sum of the Economy meter readings on the cars. The difference between the two values shows the line loss, the rail return loss and the miscellaneous consumption of energy along the right of way and on the car. We have obtained figures on this direct-current loss plus miscellaneous use, varying from 9 per cent on a trunk-line city route to 30 per cent on typical interurban lines in Indiana. With such figures available the engineers of a property can easily and accurately look for the weakest points in their distribution systems and thus remedy them and conserve substantial losses of energy.

Another desirable benefit which follows from the installation of energy-saving devices is that the distribution system is relieved of part of its load and thereby the average car operates at higher average voltage and can more easily maintain its schedule.

Another by-product of the Economy meter installation which is not strictly power saving on the car but is closely allied to it and results in money savings of such amount as to warrant the installation for this purpose alone is that of utilizing the meter to tell when the car should be inspected. One road equipped with 1,300 meters has been on the kilowatt-hour car inspection basis since November, 1918, and reports savings which would more than wipe off the cost of the meters the first year. This property is the Eastern Massachusetts Street Railway, known as the "Bay State System." We are also manufacturing, or have on order, meters with the special car inspection dials for the Union Traction Company of Indiana, the Atlantic City & Shore Railroad, the Seattle Municipal Railway, the Philadelphia Rapid Transit Company and others.

The use of the meter to determine when cars should be inspected is based on the fact that kilowatt-hour consumption between car inspections is the safest, most efficient and most readily available measure of the work done by the essential parts that wear and need inspecting. The kilowatt-hour is a measure of the work done. Mileage run, or the total power-on time, the elapsed coasting time, or the braking time, are none of them so accurate a measure of the work done as is the kilowatt-hour, and with an Economy meter on the car the total kilowatt-hours are easily available for determining that a car has done sufficient work to need inspection.

By providing a simple means for accurately and automatically showing when inspection is needed, the inspection-dial meter also shows at a glance how much work a car can do before inspection is needed. Or, in the case of a road failure, how much work has been done previous 150. And yet the factor of safety has not been as to whether an inspection has been missed. All this is had without any clerical labor. The result is that more thorough inspection is maintained for the same labor cost; or the previous standard of inspection is maintained for reduced labor cost. For example, on the Bay State System, from one carhouse there are operated twenty-one cars, five in regular service and the others during rush hours. Under the previous method of inspection each car was inspected every four days—a total of 150 inspections per month. Under the kilowatt-hour basis of inspection the average inspection period is a little over twenty days, or a total of thirty-two inspections per month compared with the previous 150. And yet the factor of safety has not been changed for those cars which did the most service. The average time necessary to make an inspection is about two hours and the resulting saving of 236 hours thus represents a saving in inspection time of about ten hours per car per month, which may either be absorbed in more thorough inspection or in a reduction of the inspection force.

The savings which will accrue to a large city property from inspection of equipment on the kilowatt-hour basis of work done are great. One metropolitan system which has studied this method for nearly a year estimates that car inspection by this method will bring about a reduction of more than $75,000 a year in the inspection cost.

A Way to Get Rid of High Ice Centers

IN ORDER to attack the high ice centers which sometimes form between rails in snowy winter weather, the Pittsburgh Railway Company constructed an ice cutting machine. This machine is simple in nature, as it consists merely of applying some specially cut old gears to the axles of wheels on a flat car

Some well worn 24-in. gears were selected, and two out of every three teeth were cut from the gear, leaving only every third tooth on the spider. These teeth in the well worn gear were already fairly sharp and were sharpened still more. Several of these gears so treated were then pressed onto one of the axles of a flat car having 23-in. wheels. The platform of the flat car was heavily loaded and when the flat car was pushed ahead of a motor car the gear teeth cut into the ice of the high center and chipped the top of the ice so that it could be easily swept away by following machinery.

There was at first some trouble keeping the flat car on the track, but this was soon conquered and the mechanism worked very satisfactorily.

Saving Electrical Energy on the Car*

The Author, Who Was Until Recently Master Mechanic of the Indianapolis Traction & Terminal Company, Comments Item by Item Upon the Points Raised by Professor Ewing

BY L. M. CLARK
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IN A discussion at this time of the economical use of energy for car purposes it appears advisable to consider the three phases of generation, transmission and utilization. Speaking broadly as to the first phase, a gradual but marked increase in the efficiency of generation has been attained, until now most of the electrical energy used by railway cars is being produced at a point approaching maximum efficiency. But the efficiency of transmission has not kept pace with that of generation. There remains considerable to be accomplished in the way of increasing the efficiency of direct-current negative returns and reducing the costs of conversion from alternating to direct current. The question of utilization is extensive and complex, due not only to the wide limitations of car and equipment design, operating schedules and the use of auxiliary devices, but to the human equation, the all-important factor with which we have at the present time to deal.

In reality, the problem of the economical use of energy for car purposes can be regarded as commencing with the contact of the current-collecting device with the trolley wire or third rail, terminating with the car wheels on the track rails, and taking into account the translation of a given amount of electrical energy in accomplishing useful work and overcoming attendant losses.

Car weight constitutes one of the principal contributing factors in the amount of energy required for propulsion. Not until recent years has such consideration been given to designs of minimum weight commensurate with safety in operation and durability in maintenance, weight reduction having been made possible by the substitution of steel for wood construction. The safety car has been steadily growing in favor and has well established the advantages of weight reduction from the standpoint of power economy.

SCHEDULE SPEED AND ENERGY ECONOMY

The next contributing factor, one of far greater importance because it is sufficiently flexible to permit economical adjustment, is schedule speed. This, with given weights of cars and loads, governs the capacities of motor equipments and the gear ratios required, very materially affecting the energy required for car propulsion. With present car equipments, taking into consideration light and loaded weights, motor capacities and characteristics, rates of acceleration and braking, number and length of stops, and roadway and power conditions, the most economical speed can be determined from the calculation of fixed charges and platform expenses per car-mile as compared with the power input and equipment maintenance expenses set up on a similar basis.

While it not infrequently becomes necessary to deviate from the employment of maximum economical speeds in order to expedite the handling of traffic, or to give service of a definite character, opportunities exist on many properties for furthering the economy of energy consumption by readjustments of schedules, taking into account the varying traffic conditions throughout the daily period of operation and any irregularities in the proper equalization of time between timing points.

In the attainment of maximum power economy the question of gear ratios should not be overlooked, particularly with the older equipments. The writer knows of material reductions in power consumption by the change of a single tooth in gearing under severe operating conditions, coincident with decrease in motor maintenance and increase in the ability of the equipment to maintain schedules. On larger systems, where a variety of equipments are operated, it is frequently possible to increase efficiency in energy consumption by redistribution of the various types of equipments, assigning them to the different lines consistent with their ability most efficiently to meet the service conditions.

The correct grading of motor resistors between the different points of the control affords a means of saving energy by making possible more rapid acceleration without excessive current peaks, which would otherwise result in slipping wheels, damage to the equipment and rough handling of cars.

Train resistance is an element which greatly reduces the efficiency of energy translation into useful work. It is composed of a number of factors varying widely according to the conditions of operation and that of the track and equipment. In cutting down resistance losses bearings of the anti-friction type offer one means, but their efficiency from a maintenance standpoint has not been satisfactorily determined. Coincident with the foregoing are reductions in losses resulting from friction between the car wheels and brakeshoes, caused by improper suspension or adjustment. With some of the older types of trucks, as well as those which have been in service for several years, the question is quite complex with regard to the brakeshoe adjustment that will promote the greatest economy in energy consumption. For example, with trucks which have become unduly worn in the journal boxes, pedestal bearings, bolster wear-plates and center bearings an adjustment of the brakeshoes which minimizes free-running friction will oft-times decrease the efficiency of braking to such an extent as considerably to increase the power consumption required to maintain a given schedule. Thus a closer adjustment, incurring greater free-running friction, might more than compensate for the increase in braking efficiency.

However, the real solution of the problem lies in the proper maintenance of trucks, as a result of which

*Abstract of discussion of paper read by D. D. Ewing at annual meeting of Central Electric Railway Association, Louisville, Ky., March 11, 1920.

correct brakeshoe adjustments may be maintained, particularly by the employment of automatic slack adjusters. These in conjunction with the use of proper braking pressures will reduce friction losses to a minimum and effect a means of maintaining maximum braking efficiencies.

Coming now to the energy required for the operation of auxiliary devices, among these electric heaters consume the most power, the amount as compared with traction power varying considerably with the type of equipments and climatic conditions. Thermostatic control affords a means of conserving energy consumption at this point to a degree which appears to warrant consideration. The use of combustion heaters largely reduces, or entirely eliminates, the item of energy required for heating, but with the increase in the cost of attendance labor, as compared with power, it becomes questionable if the electric heater is not the more economical to operate, particularly on city cars where the results of power interruption would not be serious from the heating standpoint.

In the illumination of cars a considerable saving in energy can be secured. Attention should be given to minimizing the hours of burning, not only in carhouses and yards, but during periods of service operation.

Further economies can be effected by looking after the operation of motor-driven compressors, maintaining them in good condition, keeping the brakes as well as other pneumatically operated devices on cars properly adjusted, and eliminating air leaks in the equipment and pipe connections. The proper operation of the brakes also helps in attaining this objective.

Where the Motorman Comes In

Having discussed the subject in a general way with regard to the factors involved in the car equipment and schedule speeds, let us now take up the element of utilization which affords a direct and profitable means of attaining increased efficiency, namely, the motorman.

With all the progress that has been made in the other lines touched upon in this paper, comparatively little has been accomplished in the way of increasing the efficiency of power utilization in so far as the motorman is concerned. Of the three fundamental factors of car operation quoted in order of their relative importance, namely, safety, time and economy, the attention of operating departments has been concentrated on the first-named two. The relative efficiency of motormen has been judged largely by their ability to operate cars with a minimum number of accidents and adherence to schedules, little consideration being given to the question of energy economy.

This condition existed in the absence of any available means for determining the comparative status of the motorman with regard to the degree of efficiency with which he utilizes the energy consumed in propelling a car over a given schedule, with such number of stops and length of standing time as are incurred by operating conditions.

In most cases, a student motorman is put through a schedule of instruction, supplemented by a number of trips on a car under the tuition of an instructor-motorman, and afterward he is examined with regard to his knowledge of the equipment and its operation before being put to work. Failure on the part of the motorman to attain normal efficiency is largely attributable to inability to know, from trip to trip or from day to day, what he is accomplishing other than possibly the fact that he is keeping out of trouble and on schedule time.

By the provision of a checking device, correct in principle, dependable in action and expressing its units of measurement not only on a basis of true comparison but in a manner most appealing to his sense of judgment, the average motorman is influenced to increase his personal efficiency, comparable not only with his previous records but also with those of his fellow motormen.

The efficiency of a motorman is based upon his ability to utilize the stored-up energy in the moving car in propelling it, and the unit of measurement which takes this factor into account directly indicates his true efficiency in a manner least affected by operating factors not under his control.

Standing Time Should Be Conserved

Of the several operating factors entering into the energy input required for car propulsion, it may be pointed out that most of them are fixed in so far as the motorman is concerned, so that there remain only the factors of acceleration, retardation and standing time, by the correct utilization of which he is able to economize in the use of power. Of these three factors the one by which the greatest economies can be secured is the conservation of standing time. This can be conserved not only at stops in loading and unloading passengers, but at terminals as well by elimination of all lay-over time not called for by schedules.

Next in importance is the act of retardation, in which economies in energy consumption are attained through the employment of one-application stops, involving braking pressures commensurate with car speeds, and by the avoidance of the so-termed "fanning" of the brakes, which is usually the outgrowth of habit or of erroneous ideas on the part of motormen.

Last comes acceleration, which offers means of decreasing energy consumption by eliminating running on resistance points and all unnecessary series operation. Although with a certain number of motormen further economies can be effected by the employment of more rapid acceleration, by the time the "fast feeders" are brought down to the point of consistency the net gain here is comparatively small.

Increasing the efficiency of a motorman is in reality a study of human nature combined with psychology. The interjection of technical principles or arguments beyond the scope of his judgment only tends to complicate the matter and promote retardation in progress. A direct appeal to his sense of reasoning and the establishment of environment tending to create and maintain his interest will inevitably secure his cooperation, the key-note in the attainment of successful results.

In conclusion, the writer has endeavored to bring out in a general way the more important elements entering into the subject under discussion, but from a standpoint of investment returns, he believes that no greater opportunities await the electric railway industry for economizing in the use of power and increasing the efficiency of operation than through an educational campaign among the motormen, supplemented by the use of checking devices and a follow-up system of instruction, in order to insure results of a permanent character.

Do Power-Saving Devices Actually Save Power?*

These Devices Are Merely "Measuring Sticks," Designed to Provoke a Spirit of Emulation Among the Car Operators

BY WILLIAM ARTHUR
President Arthur Power-Saving Recorder Company, New Haven, Conn.

NEVER in the history of the electric railway industry has there been such need for rigid economy as now. The rising cost of everything that the street railway uses, the competition of the jitneys, the difficulties of obtaining increased fares, all make it an absolute necessity for economy in operation. There is, therefore, no need at this time to attempt to prove that the subject of saving power on street railways is of the greatest possible importance, and one which every progressive railway man has, or ought to have, in his mind. In studying this matter one of the first questions we are likely to ask ourselves is whether power-saving devices actually do save power?

The answer to this question is, emphatically, No! Power-saving devices do not save anything at all, and this thought cannot be brought out too clearly. Power-saving devices are a means to an end. They are measuring sticks. Their purpose is to induce a spirit of friendly rivalry between motormen who operate electric cars under the same general conditions, but it is the motorman who saves. The whole power-saving situation may be summed up by saying that what we are trying to do is to get the motormen to vie with each other and, as it were, to run a race. The power-saving device merely tells who wins the race and the order in which the contestants pass the winning post.

The question at once naturally arises, cannot this spirit of rivalry be brought about without the need of power-saving devices? This experiment has been repeatedly tried and it has always been found that although something could be done to work up the motorman's interest by instruction, circularizing and other such means, yet the improvement disappeared just as soon as the first enthusiasm had passed. What is needed, if a power-saving campaign is to be effective, is something on the car which will at all times indicate whether or not the motorman has operated his car efficiently, and thereby permit of suitable comparisons being made between men. Even if a good power-saving device is used, however, very doubtful results will be obtained unless the power-saving campaign is carefully planned and the follow-up work consistently carried out.

Granting then that economy is needed, and that power-saving devices are necessary to effect any substantial economy in power consumption, the question naturally arises, how much power can be saved? To answer this question, careful and exhaustive experiments have been made in many parts of this country, and in other countries. The results of the experiments and the experience of those who have gone into the matter most thoroughly show that there is approximately a two to one ratio between a good motorman and a poor motorman; that is, between a motorman who would be considered one of the best on a property and a motorman who would be considered one of the worst. This ratio of two to one means that the poor motorman is using just about twice the power for the same service that a good motorman is using. For instance, if on a property the average power consumption is 3.5 kw.-hr. per car-mile, then the first-class motorman is probably making his run with a power consumption of a little less than 2½ kw.-hr., whereas, the careless motorman, on the same run, is using from 4½ to 4¾ kw-hr.

Recently, on a large property, and before a power-saving campaign was started, a car containing fifteen chief motormen was operated over a given route under test conditions, these conditions being that each motorman should operate the car in his own way, making stops at specified points and running at a given schedule. The power consumption per car-mile was measured. The car was then operated over the same route, making the same schedule and the same stops but operated by an expert engineer, and again the power consumption was measured. The saving made by the engineer was 35 per cent.

It is the writer's belief, based upon close study of this whole matter, that as a whole on a large property the motormen waste about 40 per cent of the total power drawn from the overhead wire. This does not mean that 40 per cent can be saved as a general proposition on any property, for the reason that all motormen are not operating as carelessly as the worst to begin with, nor can all of them be trained or worked up to the point where they are all as good as the best man.

In any large power-saving campaign the most that can be hoped for as a practicable thing and without spending too much money for the follow-up work is from 15 per cent to 20 per cent, and although this is only about half of the total amount wasted, yet it represents a worth-while saving.

It is interesting to study just the value of the energy used on a trolley car each day. A car in ordinary service runs about 150 miles a day, with an average consumption of 3.5 kw.-hr. per car-mile, and the cost for energy at 1½ cents per kilowatt-hour gives a total of $7.87 as the cost of the power used per car per day. Taking 15 per cent as a reasonable figure as to the amount which can be saved by a well-organized and well-followed-up power-saving campaign, the saving per day per car works out at $1.18. Deducting for the cost of clerical work, following up the records, instruction, maintenance, stationery and other incidental expenses, there is left a saving of approximately $1 per day per car.

In conclusion I would point out that our country, which usually is the leader in progressive means and in methods of organization and efficiency, is in this matter of power saving very much behind. In England 98 per cent of the cars are equipped with some form or other of power-saving device, and as a former English railway manager recently expressed it, when visiting over here, "English street railway men would as soon think of operating their trolley cars without wheels as without something on the car to check the motormen and prohibit the excessive and wasteful use of power." In our country fewer than 10 per cent of the cars so far are equipped. I believe, however, that we are right now confronted with the situation which makes it imperative for us to use not only this means of economy, but every other means, if our street railways are ever to get into that prosperous condition again which we should all like to see and help to bring about in so far as this lies in our power.

*Abstract of discussion of paper by D. D. Ewing, read before Central Electric Railway Association at Louisville, Ky., March 11, 1920, by W. Shaw for the author.

Snow-Removal "Tank" With Possibilities

Device Which Has Undergone Severe Tests in New York City Gives Promise of Furnishing a Snow-Handling Solution

A LARGE conveyor equipment which has been developed by Dr. S. Friedman of New York City for the removal of snow from city streets, country roads and car tracks has recently come much into the limelight through tests which have been conducted in New York. The machine is called a "snow tank." It is motor operated with four speeds ahead and one reverse and has a speed of 2 to 10 m.p.h. The dimensions are: Length 26 ft., width 9 ft. 6 in., height 12 ft. 6 in., and the weight of the "tank" complete is 22 tons. The motor is a 150-hp. Sterling Marine and the drive is Christie four-wheel.

As is shown in an accompanying illustration of a front view of the tank the snow is picked up by shovels attached to an endless chain conveyor. These shovels cut into the snow or ice as the machine moves forward and convey the material to a hopper at the top of the "tank." The bottom of this hopper is a movable platform operating in a horizontal transverse direction to the first conveyor. The hopper conveyor can be kept in simultaneous operation with the machine, thus depositing a steady stream of material into a flat car or truck or at the side of the road, or the hopper may be filled and then dumped in one spot. The capacity of the hopper is 10 cu.yd.

It is claimed that the machine will pick up material and fill a 10-cu.yd. truck in one minute. Under demonstration for a distance of one block this was actually accomplished in an average of three-quarters of a minute per truck. Other claims made for the machine, which seem to have been verified under test, are these: It will fill a flat car with soft snow at the rate of 30 to 50 cu.yd. per minute or with frozen snow at the rate of 10 to 20 cu.yd. per minute. It will clear a path in a 6-in. snowfall at the rate of 8 m.p.h., in an 8-in. snowfall at 7 m.p.h., in a 12-in. fall at 5 m.p.h., and so on up to a 24 in. fall at 2 m.p.h. The machine is said to accomplish the work of 750 to 1,200 men.

In some comparisons of costs of loading an 8-cu.yd. truck with snow by "tank" and by hand compiled by Dr. Friedman as a result of tests, it is stated that the hand-loading costs $6.12, while the "tank"-loading costs 64 cents, a difference of $5.48. This includes wear-and-tear and overhead in the case of the "tank." Allowing two hours daily for rest, filling the machine with "gas" and oil and making adjustments, it is estimated that 1,300 loads per day can be removed at a saving of $7,000 per machine per day.





AT LEFT, ON DEMONSTRATION THIS SNOW "TANK" LOADED FIVE TRUCKS IN THREE MINUTES. AT RIGHT, THE "TANK" DIGS INTO A SNOW BANK WITH SHOVELS ON AN ENDLESS CHAIN CONVEYOR

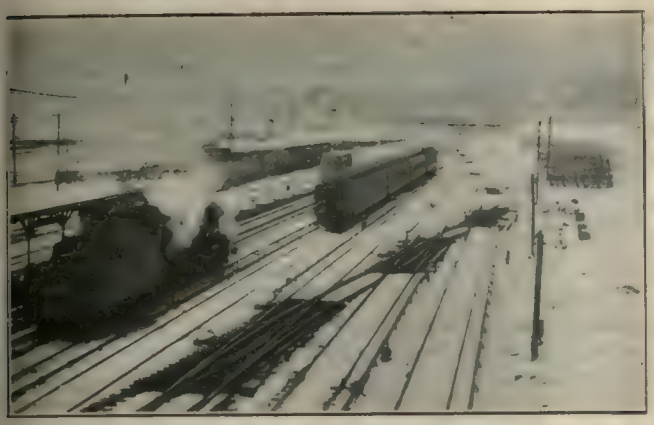
Electric Snow Melters Stand the Test of Severe Storms

Snow Melters in Use on New York Central Electrified Division Keep Switch Points Clear During Most Severe Weather in February

THE snowstorms of February, 1920, will long be remembered for their severity. Not only did a greater quantity of snow fall than during an equal period for many a previous year, but in addition the snow this year had a moisture content much greater than that of earlier memorable storms. For these reasons the past winter has been a most excellent test period for various snow-melting and snow-handling devices.

In the issue of the ELECTRIC RAILWAY JOURNAL for Nov. 16, 1918, page 881, the electric snow melters developed under the direction of Francis Boardman, division engineer, New York Central R.R., were described. During last February when snowstorms, especially in the eastern parts of the country, seriously tied up and delayed transportation, switches on the electric division of the New York Central, where the snow melters were installed, were kept clear for prompt operation of passenger trains. The efficiency of these melters was one of the important reasons which permitted suburban service to operate substantially on time during the storms. The electric heaters placed just under the rail prevent snow from accumulating between the switch points and the track rails, or around the switch connections to switch stands or interlocking machines.

The Boardman melter was originally designed in an effort to find the most economical way to dispose of snow around switches. This year, however, it has been not only a question of economy, but one of necessity, for it has been literally impossible to secure enough men to shovel or sweep snow away during a storm, and thus



THIS ILLUSTRATES THE EFFECTIVENESS OF THE HEATERS AT HARMON, N. Y.

permit anywhere near normal switch operation. This was particularly true when the storms occurred at night and during the early morning hours.

On the New York Central lines one of the most difficult places to keep clear of snow has been the interchange point between steam and electric power at Harmon, some 32 miles from New York City. This is along the Hudson River and it is exposed to high winds. The location cannot be protected in any way by snow fences. Approximately 191 trains a day pass through this point, of which eighty-three change from steam to electric power or *vice versa*, the time allowed for this change being only four minutes, including the switching change necessary and a considerable number of switch movements.

During the heavy storms of last February this plant, through the use of electric snow melters, was kept open with no delay to trains. A foreman and from eight to fifteen laborers ordinarily handle the work at this point, but during the worst of the storm there were only eight laborers available, and some of their time was spent in keeping clear the hand-thrown switches adjacent to the main line.

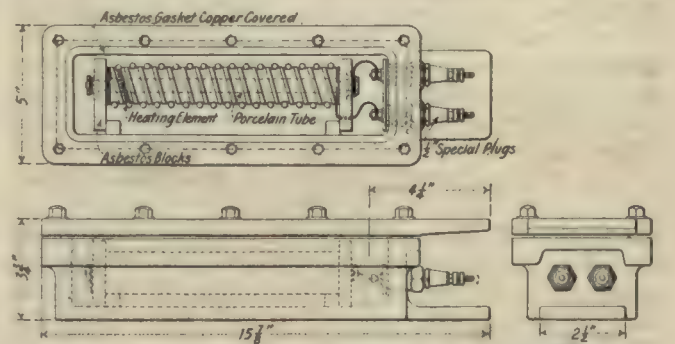
Another vulnerable point on the system is the junction between the Harlem and the Hudson divisions at Mott Haven. Here 508 trains pass daily, and over three-fourths of this number make some detouring movement by a turnout from one track to another. This location was kept clear during the worst of the storms by the use of the snow melters, together with a foreman and three laborers.



THE ELECTRIC SNOW MELTERS ARE INSTALLED AT SWITCH POINTS IN THE BALLAST UNDER THE RAIL

The snow melters were first used on the electric division where the propulsion circuit was available. They have since been developed commercially into 110-volt units so that by proper wiring they can now be applied to any electric circuit which is in common use for lighting and similar purposes. That the device has also been simplified is shown by the drawing below. The wiring connections can now be made through a spark plug and this wire connection is easy to make even though the operator is not skilled in the work.

The heating units are inclosed in a cast-iron box, the over-all dimensions of which are 15⅞ in. x 3¾ in. x 5 in. The box is water-tight and can be allowed to remain in water or melted snow without danger of injury. The melters are designed for use with either alternating or direct current and at 110 volts consume 5.2 amp. This gives a power consumption per unit of something less than 600 watts. Under extreme weather conditions about sixteen of these units are necessary to keep turnouts clear of snow where the switch points are 15 ft. to



DETAILS OF IMPROVED ELECTRIC SNOW MELTERS

16½ ft. long. This results in a power consumption of approximately 9 kw. for each turnout.

The installation of the melters is very simple if the wiring can be brought near the turnout as a trunk line as the heaters are laid loosely in the ballast just under the rail. The cost of operation is the cost of the energy consumed during a storm and depends upon the price paid for such energy. If this price is 2 cents per kilowatt-hour, the cost per hour for keeping the turnout clear would amount to approximately 18 cents. If the cost of the current were 8 cents per kilowatt-hour, the cost of keeping the turnout clear during the storm would amount to approximately 72 cents, etc. The expense continues only during a storm, when it is necessary to keep the snow from accumulating. The current can be turned on and off by a switch placed at some convenient point along the line or near the turnout, and this operation can be accomplished without any difficulty whatever by any employee who is on duty. As soon as the storm is over, the current can be turned off and there is no further expense involved. The illustration above indicates certain changes which have been made in this melter since it was previously described.

Electrification for England's Suburban Lines

AT THE recent annual meeting of the shareholders of the Great Eastern Railway, Great Britain, the general manager was instructed to prepare, in consultation with other experts, a scheme of electrification for its suburban lines. It was felt that such electrification would be profitable on account of traffic density.

A.R.E.A. Holds Active Convention

Engineering Association Meeting in Chicago Approves Rail Specifications and Discusses Screw Spikes and Substitute Ties

DEFINITE progress in important technical matters was accomplished at the annual convention of the American Railway Engineering Association held in Chicago last week. The convention lasted three days and during each session reports of considerable importance were presented and acted upon. The actual progress made in the adoption of specifications and recommendations indicates that the members present were there for business and that the railroads are entering upon their new era of private operation with a determination which is promising of wonderful accomplishment.

In his annual address, delivered at the opening session, President Earl Stimson dwelt upon the membership drive conducted during the past year. This brought into the association 180 new members, making a total of 270 since the last convention. The total membership is now 1,639. He also discussed co-operation with the American Railroad Association and explained how the A. R. E. A. had acted as the construction and maintenance division of the engineering section of that body. The problems immediately ahead of the association now, he said, are maintenance rather than construction problems.

The new officers elected for the ensuing year were: President, H. R. Safford; vice-president, L. A. Downs; treasurer, G. H. Bremner, and secretary, E. H. Fritch. The directors elected were: Edwin B. Katté, J. M. R. Fairbairn and F. E. Turneaure.

Some of the reports which contain material of particular interest to electric railway men are abstracted very briefly in the following paragraphs. Abstracts of the remaining papers of interest will appear later.

REPORTS OF INTEREST TO ELECTRIC RAILWAY MEN

Roadway—The two subjects which received chief consideration in this report were subsidence under embankments and shrinkage of embankments. In the former investigation subsidence of soil under weight of railway fills was found to be a general condition, existing to some extent under all such fills. Not only was grading material found to have subsided but also quantities of cribbing, mattress work and timbers. The subsidence appears to average 1 per cent per foot of height of fill. In the matter of shrinkage the committee found 10 per cent to be the average figure for earth and a swell of 25 per cent for solid rock.

Ballast—The report of this committee included information as to the proper depth of ballast, standardization of ballast tools, instructions for ballasting on an operated line, specifications for stone ballast and the use of reinforced concrete slabs to assist the ballast in distributing the load on soft roadbeds. The larger part of the report was devoted to the last-named subject.

The reinforced concrete slab construction has been tried with success by several roads and includes two distinct types, one having the ordinary ballasted track laid upon a slab, while in the other the rails are carried by wood blocks or stringers laid directly upon the concrete. The practice of, and results obtained on, nine different roads was described in considerable detail. The committee stated that it was satisfied that the use of these types of reinforced concrete construction will solve the difficulty experienced over "soft spots." The expense was stated to be considerable, but not unduly high, when the traffic is heavy and the cost of upkeep is reduced to very small proportions. A resolution on this subject, submitted by the committee, was adopted without discussion.

Economics of Railway Labor—This committee confined its work to a study of methods for training and educating engineering and maintenance department employees. The gist of the committee's report was that the training and education of railway engineers in the practical and economic features of their work is without method on most railways, with the result that the development of the individual is almost wholly that which comes from his being thrown upon his own resources. Systematic training and organization methods are urged as necessary for the production of an efficient engineering staff. The committee makes definite suggestions for carrying out this work.

Rail—The report of the committee on rail included statistics on rail failures. These were abstracted in the issue of the ELECTRIC RAILWAY JOURNAL of March 6, 1919, page 468. In regard to the intensity of pressure due to wheel loads the committee says that experiments indicate that moderate unit pressures may be expected where rail and wheel conform, but where this is not the case very severe kneading of the steel in the head of the rail may be expected. Specifications for carbon steel rails were submitted and recommendations were made for standardizing the drilling of rails. Both the specifications and the recommendations were adopted after some discussion.

Track—The committee on track presented specifications for (1) steel cut track spikes, (2) steel tie plates, (3) steel screw track spikes, (4) wrought iron tie plates and (5) malleable iron tie plates. Sixty plans were also submitted for turnouts, crossovers, slip switches and double crossovers, with details including such incidentals as tie plates, rail braces, riser plates, etc. Specifications were submitted for the various uses of relayer rail. Specifications 1 and 2 were referred back to the committee for further consideration.

Ties—On the subject of screw spikes this committee made recommendations as to good practice, stating that as an advantage in quick repair work and as beneficial in treating four holes should be bored in each plate-bearing area even though only two spikes were used. The committee believes it difficult accurately to measure the damage done to a tie by a screw spike until some of the modern installations have been longer in service, because as longer tie life is obtained by preserving there is more chance of spike killing being a limiting factor.

In reporting on the best methods for controlling tie renewals the committee believes that either (1) yearly field inspection by section foremen or their immediate superiors or (2) yearly field inspection by special inspectors will bring safe and economical results. On the matter of substitute ties, the committee made an extensive report on the use of some fifteen to twenty substitutes and stated that while a substitute tie, satisfactory for use in high-speed heavy-traffic main tracks has not been fully developed, there are several substitutes which have given service satisfactory enough to warrant further extensive tests. A recommendation for the continuance of the tie specifications formulated by the United States Railroad Administration was adopted.

Wood Preservation — This committee submitted

specifications for treatment with zinc chloride, with creosote oil (full-cell process), with zinc chloride and creosote oil, with creosote oil (empty cell process with final vacuum) and with creosote oil (empty-cell process with initial air and final vacuum). These specifications were adopted. Service test records were presented covering results obtained on the Delaware, Lackawanna & Western Railroad and the committee urged that all roads keep such records.

A special report was made on the treatment of Douglas fir. This described the perforating process which the committee recommended for cross ties. The committee described and gave directions for the use of the iodine-potassium, ferrocyanide-starch color reaction test for determining zinc chloride penetration. A demarcation line following approximately the 100-deg. line of latitude was submitted by the committee indicating where it is regarded as safe to differentiate between the use of zinc chloride and creosote. It was stated that even in the territory west of this line, designated for use with zinc chloride, if creosote is available its use is desirable.

Tie Treating and Handling

American Wood Preservers' Association Discusses These and Allied Subjects, Submitting Figures on Service Tests

IN HIS annual address before the recent convention of the American Wood Preservers' Association President J. B. Card stated that the wood preserving industry is in a better position today than ever before in its history. He emphasized the necessity of giving more attention to the wood-block branch of the industry without delay. This represents a sum amounting to millions of dollars and is "running wild with little attention after deliveries are made." Specifications have been prepared, but very few cities have changed over from the old method of laying the blocks on a sand cushion. President Card stated that if the association does not act soon to correct this fault the end of the wood block paving business is not far off. The association, he said, cannot afford to have failures in any branch of its business.

During the report and discussion on tie service tests, J. H. Waterman presented statistics covering ten years of service with treated ties on the Chicago, Burlington & Quincy Railroad. Of beech ties, treated with creosote, 0.2 per cent had been removed in ten years; of those treated by the Card process (zinc creosote) 2 per cent had been removed; of those treated with zinc chloride 5.8 per cent had been removed; and of untreated ties 96.1 per cent had been removed.

With hard maple ties 0.8 per cent of those treated with creosote and 1 per cent of those treated with the Card process had been removed in ten years, while with this tie untreated 98 per cent had been removed in that time. No creosoted red oak ties had been removed during ten years of service, while 0.6 per cent of those treated by the Card process had been removed, as likewise had 1.9 per cent of those treated with zinc chloride. Of the untreated red oak ties 93.7 per cent had been removed at the end of ten years.

The report of the committee on plant operation covered the subject of mechanical handling of treated material, dividing the devices into seven classes as follows: (1) Stationary stiff-legged derrick with movable boom; (2) cable-ways; (3) stationary crane with electric hoist; (4) movable electric hoist, gantry type; (5) movable electric hoist, monorail type; (6) locomotive crane; (7) miscellaneous. Tests made with these various mechanical devices resulted as follows:

Results of Tests

(1) With this equipment whether hand or power operated ties can be loaded into open top cars in tram-car lots for about 1½ cent each. (2) This device is of only limited usefulness. (3) This equipment capable of lifting a tramload of ties is operated by two laborers. On a test 138 ties per man-hour were handled. (4) Three men are required to operate this hoist. On a test 194 ties per man-hour were handled. (5) The steel framework of this crane is erected longitudinally over a standard-gage track and the crane slings of the gantry crane are replaced by a pair of grapple hooks large enough to handle a tramload of ties at one time. Two men are required to operate this crane. On a test, 276 ties per man-hour were handled. (6) With an eight-wheel M. C. B. truck-type crane, with a boom having an effective working radius of 10 to 35 ft. and a maximum lifting effort of 15 to 20 tons at the minimum radius, two or three men besides the crane man are required. On a test ties were loaded into coal cars at the rate of 360 ties per man-hour. (7) Under this heading the Angier tie loader was considered. This is a device for loading treated ties into closed cars, saving much of the heavy lifting incident to hand labor. It is operated by day laborers or piece workers and effects savings of about ⅛ to ¼ cent per tie on the piece work basis.

Other Subjects Discussed

In a paper on "Rapid Deterioration of Sap Pine Ties," the conclusions reached were that pine cross ties should reach the treating plant as quickly as possible and be treated at the proper time. Many plants estimate the age of cross ties when arriving at the plant and add to this age the customary time allotted for the proper seasoning, treating the ties at the expiration of this time. This system should be corrected by the use of the dating hammer as soon as it can be applied.

In a discussion on the effect of preliminary steaming in the treatment of air-seasoned ties, it was stated that tests showed that due to the use of preliminary steam, the net absorption in the treatment of red oak ties was increased 12.6 per cent and the net absorption in the treatment of sap pine ties was increased 52.2 per cent.

The iodine-potassium, ferrocyanide-starch color reaction tests for determining the penetration of zinc chloride in cross ties was described. It was stated to be evident that in treating wood with water-soluble salts some indicator is necessary to determine the penetration of the colorless solution into the wood. The iodine method for determining zinc-chloride penetration is based on the principle that zinc ferrocyanide liberates free iodine, and free iodine in turn gives a dark blue stain with starch solution, thus making the depth of penetration clearly visible.

The fact that duration of employment is a factor in accident reduction was brought out recently in an investigation made by the Ford Motor Company. An inspection of the last twenty-five accident cases occurring before the report showed that of the employees involved, twelve had been in the company's employ less than six months and only one more than a year.

Applying the Automatic Substation*

General Principles Are Stated and Illustrated by Details of a Proposed Installation on an Interurban Line in the East

BY C. A. BUTCHER
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

IT IS estimated that there are 15,000 railway and lighting substations in the United States and that 40,000 men are required to operate them. If half of these men can be released for other work they will help to meet the crying need of today for increased production. This can be done by making the stations automatic.

An illustration of what can be saved by automatic control is furnished by the following summary of a report recently made on an Eastern property operating a double-track line between two cities of approximately 200,000 population each and 80 miles apart. Its schedule is essentially one car each way every 40 min. Local cars are operated on a schedule speed of 23 m.p.h. and limited trains at 30 m.p.h. Power is supplied to the line from duplicate three-phase, 25-cycle, 33,000-volt high-tension lines which parallel the right-of-way. The trolley wire is fed at 600 volts from eight substations spaced approximately ten miles apart and which may be switched to either high-tension line. There is a No. 0000 trolley wire over each track, and in addition two 500,000-circ.mil feeders run the entire length of the line. Rails are 70 and 90 lb. per yard, all well bonded. A number of the substations are each equipped with a spare machine and transformers.

BALANCE SHEET FOR PROPOSED INSTALLATION OF AUTOMATIC CONTROL ON INTERURBAN LINE

Investment Required:		
Seven new substation buildings		$20,000
Eleven automatic switching equipments (including oil circuit breakers, lightning arresters, automatic high-tension transfer switching and auxiliaries)		125,400
Freight		575
Installation of switching equipment and moving old rotaries and transformers		16,300
Total		$162,275
Replacing 18 52 miles 500,000-circ mil copper messenger with 7-16 in. galvanized messenger at $325 per mile		$6,030
Taking down and reeling 66 58 miles 500,000-circ.mil copper feeder at $50 per mile		3,330
Extension of transmission line		4,350
Gross investment		$175,985
Credits:		
85 1 miles 500,000-circ. mil copper feeder at 18 cents per pound (scrap value)	$123,000	
Salvage other material	6,000	
Total	$129,000	
Net investment		$46,985
Annual savings:		
Operators' wages eliminated		$22,330
Power saved		2,860
Coal saved (substation heating)		200
Total		$25,390
Annual charges:		
Inspectors' wages	$4,725	
Fixed charges (except interest) on net investment	4,230	
Total	$8,955	
Net annual saving		$16,435
Return on investment (including 6 per cent interest),		34 9
Return on investment (less interest), per cent		28 9
Total investment would therefore be returned in approximately 3½ years		

It is proposed to retain five of the present substations and to equip each of them with automatic control and high-tension oil circuit breakers to replace the present stick-type breakers. Four of the present substations are to be moved to new locations and there will be four additional substations made up of equipment now used as spare apparatus in other stations. This will make a total of seven new buildings and eleven automatic control equipments, together with high-tension switching for each station.

Alternate stations will be connected to either transmission line. In addition to manual sectionalizing of both lines at the power plant located near the center of the line, four substations will be equipped with automatic high-tension transfer switches so that in case of trouble on one line the station will immediately and automatically transfer to the other. After the trouble has been cleared and the line returned to normal service the station will immediately and automatically transfer itself back to the line to which it is regularly connected. This transfer switching requires an additional high-tension breaker for each of the four substations, together with necessary control and potential transformers with relays, etc., for testing out the line preliminary to the switching operation. With this scheme of operation but one station will be thrown out of service in case of trouble on either line.

It is planned to make the above changes in four steps and in such a way that the salvage value of copper taken down may be made available for carrying on the work. The accompanying table shows the whole thing in a nutshell.

The labor saving shown in the table is based on two 12-hr. shifts of one man each per substation. An 8-hr. shift will soon be demanded, so that it is safe to assume that the item of labor will soon be increased by a third. Under this condition the net annual saving would be increased to $23,878, thus making the return, including interest, 50.8 per cent, or a net return of 44.8 per cent. Thus the investment would be returned in approximately two and a quarter years.

At the present time this railroad has an enviable record for a high percentage of trains on time and it is believed that very little improvement in that line is possible. However, by the new arrangement, the average trolley voltage at the car will be increased by 20, thus making possible the above tabulated annual energy saving. In addition the improved trolley voltage will give greater leeway in the schedule because of the increase in running speed thus made possible. With one substation out of service the average voltage drop between stations on either side of the one that is idle will be 109 volts, compared to the present normal average drop of 74.5 volts. However, even with one station out of service, under the new arrangement the average over the entire line will be increased by 13 volts over the present normal average voltage.

In conclusion it may be well to say that automatic operation is not an economy in every proposition and in others it is not to be recommended. But by far the greater number of substations can be operated automatically with economy and improved service.

New substations automatically operated offer an economical and very satisfactory solution of the problem where increased capacity is required.

To insure continuity of operation, many substations contain spare equipment. In some cases new buildings can be erected at intermediate points and the spare apparatus when moved can be made automatic. The whole cost of this might be covered by the salvage value of the feeder copper removed.

Each proposition is a study in itself, so that here, in only a general way, has the attempt been made to point out the advantages and the savings that are to be had.

*Abstract of paper read at meeting of Wisconsin Electrical Association, Milwaukee, March 25, 1920.

Tie Rod Specifications Assist in Reducing Failures

The Specifications for Tie Rods Used by the Public Service Railway of New Jersey Are Given with Comments on Their Essential Features

BY HOWARD H. GEORGE
Assistant Engineer Public Service Railway, Newark, N. J.

TWO preceding articles on truck material specifications have covered spikes and bolts. The present one deals with specifications for tie rods. Failures of tie rods are not uncommon, especially where they have been installed in old track for the purpose of regaging. The original base of the rail may have been comparatively narrow or it may have been reduced by rusting or other causes so as to leave the rail base in an unstable condition. This condition is generally more noticeable where old and partly decayed ties are allowed to remain in the track, and it is likely to occur more frequently in track constructed with 9-in. than 7-in. rails. Failures also occur more often where rails are located so that the center of the wheel bearing does not coincide with the center of the rail web. In this case there is a tendency for the rail to tilt outward and the load is distributed unequally over the base of the rail to the tie. The unit compressive stresses in the wood fibers are thus much greater along the outer edge of the rail base than along the inner edge. Consequently the rail cuts the tie much more quickly and produces excessive play of the rail, a loosening of the spike fastenings and wide gage of the tracks. The function of the tie rod is to prevent the spreading of the rails and, since this action is more severe on curves, it is very desirable to install both tie rods and either rail braces or brace tie plates on them.

It has been found that a spacing of tie rods on 6-ft. centers has given very satisfactory results in most cases, although some engineers recommend a spacing as low as 5 ft. Tie rods should be located as near the head of the rail as possible in order to be of the greatest value. The vertical play of the rails develops bending stresses in the tie rod in addition to the direct tensile stresses caused by the spreading action. The greatest bending occurs just outside the inside nut, and it is believed that most of the failures of tie rods occur at this point or somewhere between it and the point where the section changes from flat to round, although some breaks have been known to occur between the two nuts. It is believed, however, that in the latter instances failure has been caused by loosening of the nuts sufficiently to permit play between them. It is because of these bending stresses that it is essential that a certain ductility in the material be provided for in the specifications.

Several years ago the Board of Supervising Engineers, Chicago Traction, made some tests on tie rods of various descriptions to determine the actual tensile strength of each.* Three types were tested, the first made by welding a round terminal to a flat bar, the second made by reducing the flat portion and upsetting to make the round terminals, and the third made by turning over the ends of the flat portion and upsetting to make the round terminals. The second method was followed in the manufacture of the tie rod shown herewith. In every case the rods made by the first two methods failed at the junction of the round and flat sections, each type developing practically the same tensile strength. Those made by the last method failed in the threaded terminal, but developed a higher tensile strength than the specimens made by the first two methods.

Still another method of manufacture which has been tried is by rolling the flat section from 1-in. round bars. This has never been very extensively adopted, probably on account of the difficulties and increased cost of manufacture. Some railway companies have also used tie rods of a circular section throughout. The advantage of course lies in the fact that they can be readily made in any machine shop, since commercial sizes of round bars are readily obtainable from stock and facilities for threading are generally close at hand. However, while these may answer admirably in open track or where the paving is macadam, there are too many objections to their general use to warrant very serious consideration. The principal objection to the round tie rods is that their diameter, which cannot well be made less than $\frac{7}{8}$ in. and will more often be 1 in., is such that entirely too wide a joint is produced in the paving. The round rod also offers practically no resistance to turning as does the flat rod, and this element might tend to cause the nuts to loosen. Another advantage of the flat rod is that it lends itself more easily to installation on account of its greater flexibility, this feature being especially desirable on those roads which have been using tie rods with threads of equal length on the two ends.

Attention is called to a feature of the design of the tie rod reproduced in connection with these specifications which, while not entirely peculiar to our own property, is still far from being in general use throughout the country and is decidedly advantageous. A length of 3 in. has been threaded on one end and one of 6 in. on the other to eliminate the necessity of trackmen bending the rods in order to get them through the holes in the rail webs. As a further aid to the trackmen in making the installation, the specifications provide that all nuts must be fitted to turn by hand. If a nut can be turned all the way back on the threads by hand, the trackman will do this and the rod can then be placed without bending, but if a nut turns hard he is very apt to bend the rod rather than turn the nut back with a wrench.

In determining the length of the threaded section on each end of the rod for any particular property, consideration must be given to the thickness of the webs of all the rail sections in actual use, together with

*See second annual report, page 189.

Steel and Iron Tie Rods

1. Material:

If steel, it shall be made by the open hearth or other approved process. If necessary, heat treatment may be used to secure the desired physical properties.

If of iron, the iron shall be double refined, tough and fibrous and uniform in character and quality throughout. It shall be thoroughly welded in rolling and be free from cracks, flaws, blisters and other surface defects. If necessary, heat treatment may also be used to secure the desired physical properties.

2. Chemical Composition:

The steel in the finished tie rod shall conform to the following chemical analysis:

Carbon — from 0.20 per cent to 0.35 per cent.

Manganese — from 0.60 per cent to 0.90 per cent.

Phosphorus — not more than 0.04 per cent.

Sulphur — not more than 0.07 per cent.

Silicon — from 0.10 per cent to 0.20 per cent.

3. Physical Properties and Tests:

The steel shall conform to the following physical requirements:

(*a*) Elastic limit not less than 30,000 lb. per square inch.

(*b*) Elongation not less than 20 per cent in 8 in.

(*c*) Reduction of area not less than 40 per cent.

(*d*) Elastic limit shall in no case be less than 50 per cent of the ultimate strength.

(*e*) The ductility of the steel in the rods shall be determined by the cold bend test, which requires that the material used in the rods shall bend cold through 180 deg. and flatten itself without fracture on the outside of the bent portion. The bend shall be made on the unthreaded portion of a finished rod. It is not necessary that the rod shall bend double in the threaded portion.

The iron shall conform to the following requirements:

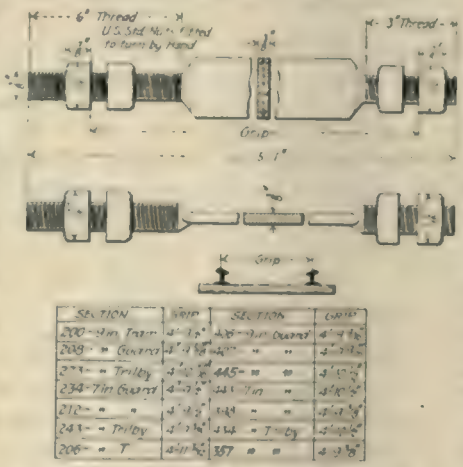
(*a*) Ultimate strength, not less than 50,000 lb. per square inch.

(*b*) Elastic limit, not less than 50 per cent of the ultimate strength.

(*c*) Elongation, not less than 18 per cent in 2 in., with the fracture wholly fibrous.

(*d*) Reduction of area not less than 25 per cent.

(*e*) The finished tie rod, when bent back on itself through 180 deg. and hammered down, shall show no signs of fracture on the outside of the bent portion. The bend shall be made on the unthreaded portion of a finished rod.



TIE ROD FOR 4 FT. 8½-IN. GAGE

In either case, a sufficient number of tests shall be made to satisfy the railway company's inspector that the material meets the specifications in every respect, and he shall have the privilege of selecting the specimens to be tested.

4. Workmanship and Finish:

The form and dimensions of both the steel and iron tie rod shall conform to the drawings submitted by the railway company and forming a part of these specifications, subject to the following permissible variations from the dimensions shown on the drawings.

(*a*) The length shall not be more than ½ in. shorter, nor more than ½ in. longer, than that shown in the drawing.

(*b*) The diameter of the threaded portion or terminal shall not vary more than 1/32 in. from the diameter shown on the drawing.

(*c*) The length of the threaded portions or terminals of the rod shall not vary more than ½ in. from those shown on the drawing. The threaded ends of the rod shall conform to the U. S. standard cut thread.

(*d*) The outside dimensions of the nuts shall not vary more than 1/32 in. from those shown on the drawing. Each terminal shall be fitted with two hot pressed square nuts, four nuts to each rod. Each nut must be fitted to turn by hand.

(*e*) The width of the flat portion of the rod shall not vary more than 1/32 in. from that shown on the drawing.

(*f*) The thickness of the flat portion of the rod shall not vary more than 1/32 in. from that shown on the drawing.

5. Inspection:

When required, the manufacturer shall furnish samples of rods from a preliminary rolling before proceeding with the filling of the order and shall give sufficient notice in advance of the date when they will be ready for inspection.

The railway company's inspector shall have a free entry at all times, while the work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered.

The inspection shall be made at the mill and the manufacturer shall afford the railway company's inspector, free of cost, all reasonable facilities to satisfy himself that the rods are being furnished in accordance with these specifications. The tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.

Three test specimens shall be selected at random from each 100 of the finished rods by the railway company's inspector. If two of them meet the requirements of the specifications the lot will be accepted, but if two fail the lot will be rejected.

If, after shipment, any rods are found to be defective, due to poor material or bad manufacture, they may be rejected.

6. Marking and Shipping:

When the rods are shipped, they shall have the nuts applied for at least the length of the nut and shall be properly oiled to prevent rusting. They shall be securely wired together in bundles of five rods each, and each bundle must be plainly marked as to material, name of manufacturer, length of rods, and name and shipping address of consignee.

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the maximum and minimum amounts by which the gage lines are offset from the webs, so as to permit the determination of the maximum and minimum grip that must be provided for. The total length of the rod and the length of the longest thread which will be required to permit installation of the rod when one nut is threaded back as far as it will go, without bending the rod, can then be figured. On some properties like our own, where it is necessary to operate over more than one gage of track, rods of suitable lengths must be provided for the several gages.

It was shown in preceding articles that the cost of inspecting track spikes and bolts is very low and the same is true in the case of tie rods. Inspection can be made at present at the rate of about $1.60 per net ton. Since the average weight of the tie rod shown is approximately 13.5 lb. the cost of inspection amounts to about 1 cent each. As to the cost of the tie rods themselves, this of course will vary considerably, but will probably be somewhere between 65 and 80 cents each at present, so that the percentage increase in unit cost is so small due to inspection as to be practically negligible.

Co-operation Between Traction Company and Farmer

Express Department of Connecticut Company Has Practical Plan for Cutting the "H.C.L."

By V. S. Curtis
General Traffic Agent the Connecticut Company, New Haven, Conn.

DURING the week of Feb. 9 to 14 the Connecticut Company's express department maintained an exhibit in the agricultural and manufacturers' display, conducted in the State armory in Hartford, for the purpose of showing the utility of the company's service in transporting produce from the farms directly to consumers in the cities.

Some three years ago an effort was made to introduce the "home hamper" idea which had been successfully operated by the Long Island Railroad, but the plan was interrupted by the war. Recently the project was taken up again and by the aid of the farm bureau and the city market experts the active co-operation of a group



EXHIBIT OF CONNECTICUT COMPANY AT AGRICULTURAL AND MANUFACTURERS' DISPLAY

of progressive farmers was enlisted. The State Grange, through its master, has taken an interest in the proposition and the officials of the State Agricultural College at Storrs have encouraged the trolley management.

The State farmers produce only about 16 per cent of the farm products consumed in the State, and they are keenly alive to the business opportunity presented by the plan of the Connecticut Company. A reference to the straight-line map seen in the exhibit will show the territory served by the express department.* At the principal cities wagon service is maintained. The company is prepared to secure lists of persons of assured credit in the cities and by correspondence or otherwise introduces them to reliable farmers vouched for by the Grange Farm Bureau or market reporting service. The consumers will be advised of the kind of products of the farm that each farmer can supply and orders will be placed with the farmers. Crates or hampers have been planned which hold six 2-qt. baskets each. These will be packed by the farmer in a careful and attractive manner and taken by him to the point on the electric line nearest to his farm. They will be picked up by the crews of the express cars and delivery will be effected by the regular express wagons of the company, the consignee paying the transportation charges by check.

At the exhibit two hampers prepared by David A. Clark of Milford, for customers in New Haven, were shown. One hamper contained a home-cured and smoked ham, a fine chicken, potatoes, carrots and turnips. Its value was not stated by the shipper but it was appraised at about $9 by the city market expert and on consultation with the shipper it was found that the expert had exceeded Mr. Clark's estimate by about twenty cents. This fact is mentioned because it is proposed to follow closely the fluctuations of market prices, and differences of opinion as to fairness of prices that may arise between shippers and consignees will be arbitrated by the city market experts. These gentlemen and the Farm Bureau and Grange experts will also pass on the quality of goods sent, and any tendency to unload low-grade goods or defective products will be checked. The plan generally will result in the consumer getting high-quality goods direct from the farm at a low retail price and the farmer will receive something better than a high wholesale price. The consumer will be sure that the corn from the farm has not been aged sufficiently to turn to starch nor handled and re-handled by team or motor-truck from farm to city market, to huckster, to retailer and thence to him. The tomatoes and peas will have no chance of being bruised and heated. The lettuce will be fresh and crisp, not wilted and crushed.

The slight publicity accorded the exhibit by the daily press has resulted in many inquiries from hopeful consumers, and the problem confronting the sponsors of the scheme is to find the farmers. It may be necessary to plan community or neighborhood effort in rotating crops, and in this the granges locally and the country Farm Bureaus will assist.

*Details of the work of this department were given in an article in the issue of this paper for Nov. 8, 1917, page 802.

Douglas Fir for Ties

ACCORDING to a statement in the *Railway Maintenance Engineer* a test of Douglas fir cross ties installed in the main line of the Great Western Railway of England resulted in only twenty-three out of 616 ties originally laid being removed after seventeen and a half years of service under heavy traffic.

The original ties upon which records were kept consisted of high-grade Douglas fir timber, sawn to size, 10 in. x 5 in. x 9 ft. The ties were comparatively dry when received, and were kept in stock only nine weeks to finish the seasoning process before they were subjected to the preservative process. The method of preserving consisted of impregnating the ties with a creosote oil, the total amount of absorption averaging about 0.8 gal. per cubic foot of timber treated.

The ties were placed in service May 1, 1898, in main-line track where the maximum grade was 0.06 per cent, descending on a 4 deg. curve. The subgrade at this point was an embankment composed of marl and gravel, and the ballast used was crushed rock. The track construction consisted of standard 45-ft. rails, of bullhead cross-section and weighing 92 lb. per yard, supported by chairs. Upon inspection all ties were found in serviceable condition until October, 1915, when twenty-three were removed on account of decay.

The National Safety Council has, through its educational committee, just secured the co-operation of the national organization of Boy Scouts.

Letters to the Editors

Anent Standard Track Spirals

SOUTH COVINGTON & CINCINNATI STREET RAILWAY COMPANY, INC.

COVINGTON, KY., Feb. 23, 1920.

To the Editors:

I am pleased to see that the sub-committee on standard track spirals of the committee on way matters has gathered and submitted data. It will be of great value to both the manufacturer and the street railway to have standard spirals. However, any system of spirals that may be adopted must, to secure general use, be as good as any now employed and should be flexible enough to meet any condition that may arise in ordinary track work.

The method of numbering and developing the suggested spirals is excellent, but there is some criticism of the particular spirals selected. Compare the proposed spiral No. 5.3 with the Lorain spiral No. 2-A. The initial radius of Lorain spiral No. 2-A is 560 ft. while that of the proposed standard spiral No. 5.3 is 304 ft. Spiral No. 2-A is, however, shorter and I believe is better suited to street railway work, because of the shorter arc length and smaller initial angle.

I suggest that the initial angle and angular change be made twenty minutes rather than 1 deg. This would result in shorter arc lengths and a better and more flexible spiral. Numbering as in the proposed standards, a spiral number denoting the length of arc of that spiral in feet and tenths, I would suggest spirals No. 1, 2, 2.5, 3, 4, 5, 7.5 and 10. It seems to me that the standard spirals proposed by the committee are not correctly proportioned to the radii of the curves with which they are to be compounded.

No spirals should be adopted by the association as standard without the widest possible discussion.

W. T. ROSSELL,
Superintendent of Track and Buildings.

[NOTE.—Upon receipt of the communication from Mr. Rossell the editors referred it to E. M. T. Ryder of the committee on way matters in order that a reply to the suggestions might appear in the same issue with the original communication. Mr. Ryder's reply is printed below.—EDITORS.]

THIRD AVENUE RAILWAY SYSTEM

NEW YORK, N. Y., March 10, 1920.

To the Editors:

Such comment on standard track spirals as is made by W. T. Rossell, superintendent of track and buildings, South Covington & Cincinnati Street Railway, in his letter of Feb. 23 to the JOURNAL is of interest in bringing out particular points in regard to the standards proposed by the committee on way matters of the American Electric Railway Engineering Association.

Mr. Rossell brings up the question of arc length and length of initial radius, and compares proposed spiral 5.3 with the Lorain spiral 2-A, calling attention to the fact that the "initial radius of Lorain spiral 2-A is 560 ft. while that of the proposed standard spiral 5.3 is 304 ft." He evidently regards the longer initial radius as of advantage and also suggests the use of shorter arc lengths with correspondingly smaller initial angles.

Theoretically the length of initial radius of the spiral can be increased any desired extent by shortening the arc lengths. For practical purposes, however, with any spiral of the Searles type, which has a uniformly increasing rate of curvature, the one really important function is the total length of the spiral. This total length may be obtained in a spiral of four chords or eight chords or sixteen chords, with no particular difference as regards the riding qualities of the curve provided the chords are not so long as to give an angular change abrupt enough to give a shock in the same way, although in less degree, as is experienced in changing abruptly from a tangent to a circular curve. The difference between Searles or similar spirals of the same total length and with various arc lengths is astonishingly small.

I happen to have before me a blueprint of a drawing prepared many years ago by Wm. Wharton Jr. & Company, Inc., comparing a spiral of eight arcs with one of four arcs, holding the same extreme tangent points and total angle. The differences between the two sets of ordinates from the tangent to the compounding points of the curves, the figures being decimals of a foot, are: At the first compounding point, — 0.0061, second — 0.0067, third + 0.0078, fourth + 0.0024, fifth — 0.0050, sixth — 0.0010, seventh + 0.0054.

There is on the other hand a practical objection to having very short arc lengths in that it increases the cost of manufacture both on account of increased expense in the engineering department and in the shop. In the spirals proposed by the way committee the length of arc for those spirals which will be in most common use does not differ greatly from the gage of the track and the total variation of those spirals which it is proposed to use for branch-offs is from an arc length of 4 ft. to an arc length of 8 ft. 6 in.

Mr. Rossell's comment that "no spirals should be adopted by the association as standard without the widest possible discussion" is very sound and it is to be hoped that other engineers will follow his example and give the way committee the benefit of their ideas on this subject.

E. M. T. RYDER,
Engineer, Maintenance of Way.

Beam Type Track Weak in Tie Between Rails and Short on Bearing Area

THE KANSAS CITY RAILWAYS

KANSAS CITY, Mo., March 23, 1920.

To the Editors:

The type of construction which provides for the laying of concrete paving in one mass with the concrete that is used in the track foundation is undoubtedly good, but in the type that is described in the article on page 609 of ELECTRIC RAILWAY JOURNAL, issue of March 20, 1920, I see some structural weaknesses that are bound sooner or later to cause trouble. It is stated that this track and pavement have given satisfactory service over a term of about four years. I do not question but that such results may be obtained on track so constructed under light traffic, under favorable soil conditions and in mild climate, but one should not be led to use a construction of this type under any and all conditions, particularly in wet clay soils and in climate where the frost penetrates far below the surface.

In the construction described the heavily reinforced beam is undoubtedly of sufficient strength to give the effect of very deep rail and longitudinally the construction is sound; but the two rails are only bound together by a light tie bar and a 5-in. concrete pavement. This is not a sufficient bond between the two rails and the settlement of one beam more than the other will cause longitudinal cracks in the concrete. Failure of the pavement inside or outside of the rails will result in change in gage that will be aggravated from day to day under traffic and it will result eventually in corrugation and the general breaking up of the structure. To guard against matters of this kind it is essential that the rails be bound together at some point below their base by means of ties of steel or wood or a mass of concrete, so that with any pressure from frost or any settlement of the track the two rails are bound together and move as one. The fact that one rail can settle independently of the other has been the principal factor in the failure of the beam type of construction.

I am not advised of the unit cost of this construction, which is a matter of vital importance, but I am of the opinion from the comparison of the amount of material required and the estimated amount of labor, as based on our local conditions, that this track would cost 25 per cent more than track with a similar rail section with white oak or steel ties constructed upon a solid slab of concrete. I judge from the cross section of the track described that there would be a great deal of difficulty in the placing and maintaining of the rails to the proper surface and line while the work of concreting is in progress and that the handling and placing of so many separate parts would result in excessive labor costs.

It is also pointed out that only the area of the bottom of the beam on the soil can be depended on to carry the load to the subgrade, an area of 2 sq.ft. per lineal foot of track; whereas with ties on ballast or concrete the area in practically every other type of construction is 9 sq.ft. per foot of track.

The theory of the beam type of construction is unsound and the use of this form of construction has almost invariably resulted in failure and will only give satisfactory results temporarily and under favorable conditions.

A. E. HARVEY,
Chief Engineer.

Illinois Committee Appointments

At a joint meeting of the executive committees of the Illinois State Electric Association and Illinois Electric Railways Association and the board of directors of the Illinois Gas Association two joint committees were appointed, one to be known as the Joint Public Policy Committee, composed as follows: For the electric railways, E. C. Faber, chairman; Britton I. Budd and J. R. Blackhall; for the electric lighting companies, Frank J. Baker, R. S. Wallace and H. E. Chubbuck; for the gas companies, W. M. Willett, A. D. Mackie, Bernard J. Mullaney and R. V. Prather. The second committee will be known as the Relations to Educational Institutions Committee and will be composed as follows: R. V. Prather, chairman; for the electric railways, H. E. Chubbuck and E. C. Faber; for the electric lighting companies, B. J. Denman and Frank J. Baker; for the gas companies, H. H. Clark and A. D. Mackie. This is another progressive step by these associations in line with the work of the committee on public utility information.

Association News

Mr. Henry Before I. C. C.

Argues That Electric Railways Should Not Be Included in Properties Covered by Transportation Act

AN INTERPRETATION of the transportation act as it applies to interurban electric railways was asked of the Interstate Commerce Commission on March 22 by Charles L. Henry, chairman of the committee on national relations of the American Electric Railway Association. He explained that there is uncertainty among the operators of interurban lines as to the application that will be made of the clause in the bill which excludes from the operation of the law such interurban electric railways as are not "engaged in the general transportation of freight." Mr. Henry urged that the commission interpret the clause so as to exclude at least all interurban lines whose freight receipts do not exceed one-half of their entire revenue.

Mr. Henry told the commission that it would be very unfair to include interurban lines under the act, thereby grouping them with the steam railroads and subjecting them to the provisions of the law covering valuation and the fixing of rates so as to yield 5½ per cent on the capital invested. While such a return might be fair to the well-established steam roads, it would in no way be an adequate return to the interurban lines, since the steam roads are in a position to get money much cheaper than are the interurban companies. It would be necessary to increase the percentage to seven or eight in order to be fair with the interurban lines, Mr. Henry declared. If the commission should interpret the act so as to bring any considerable number of the interurban lines under the transportation act, Mr. Henry declared that it would serve to check the development of the industry.

No one of the commissioners asked questions during Mr. Henry's presentation, and as a result there was no indication as to what ideas the commissioners may have in the matter. Mr. Henry expressed the personal opinion that it would be so economically wrong and so manifestly unnatural to bring the interurban lines under the purview of the transportation statute that he feels certain that no effort will be made to claim jurisdiction over any interurban lines excepting those which receive more than one-half of revenue from the transportation of freight.

Mr. Henry has recently taken over the management of the Washington office of the American Electric Railway Association and is making plans to render a complete Washington service to the member companies of the organization. An outline of his plans was given in the issues of this paper for March 6, page 483, and March 13, page 546.

On March 19 a meeting of the committee on national relations of the association was held at Mr. Henry's office in Washington. In addition to Mr. Henry those in attendance were: A. W. Brady, Anderson, Ind.; L. S. Storrs, New Haven; C. L. S. Tingley, Philadelphia; Frederick S. Pratt, Boston; C. E. Thompson, Chicago, and E. B. Burritt, secretary of the association.

Equipment Committee Meets

A MEETING of the Engineering Association committee on equipment was held in New York City on March 18 and 19. Those in attendance were: vice-chairman H. A. Johnson, Metropolitan West Side Elevated Railway, Chicago; W. S. Adams, the J. G. Brill Company; H. A. Benedict, Public Service Railway; E. D. Priest, General Electric Company; F. W. Sargent, American Brake Shoe & Foundry Company; C. W. Squier, ELECTRIC RAILWAY JOURNAL, and J. W. Welsh, special engineer of the association.

The large amount of material which was presented by the various subcommittees for consideration showed the activity and interest that was being manifest in the work. A form of questionnaire for obtaining information on the life of wearing parts was approved, and this will be sent to various railways soon.

An additional subject, that of obtaining information of value in fighting snow and safeguarding equipment under extreme weather conditions, was assigned.

New England Street Railway Club

Noted Speakers Address Five Hundred Members and Guests at Twentieth Annual Banquet

ABOUT 500 members and guests attended the annual banquet of the New England Street Railway Club held at the Copley Plaza Hotel, Boston, on the evening of March 25. After the dinner I. A. May, comptroller the Connecticut Company, the newly elected president, expressed his appreciation of the honor of his election and then introduced as toastmaster for the evening Hon. Samuel L. Powers, one of the State trustees of the Boston Elevated Railway. Mr. Powers acted most acceptably in introducing the four scheduled speakers. Hon. Calvin Coolidge, Governor of Massachusetts, made the first address and expressed a plea for the collection, not the dissipation, of capital. If its production is secured its distribution follows. He also urged the building up and strengthening of the transportation utilities as of benefit to the public.

Mayor Andrew J. Peters of Boston, who followed Governor Coolidge, described the railways as an essential part of the public life and advocated a close co-operation between them and the public.

Governor William C. Sproul of Pennsylvania, the third speaker, discussed principally the necessity of all citizens taking an active interest in political affairs and insisting upon the administration of national and state undertakings on a business basis. He also stressed the importance of good transportation to the nation's prosperity.

Matthew C. Brush, now president American International Shipbuilding Company, the final speaker, congratulated the club that speakers of such prominence had addressed them and expressed such opinions on the necessity of fair treatment of the railways. He urged team work and support of both the club and the American Association. Railway men should not be required to apologize for asking for the things they need to give good transportation service. They should also take an active interest in the selection of authorities who will give a business administration. Mr. Brush then gave an extended account of the work of the American International Shipbuilding Corporation at Hog Island.

The entertainment of the evening concluded with an exhibition of moving pictures of the Hog Island ship yards, with explanations by Mr. Brush.

At the annual election in the afternoon the following officers were chosen: President, I. A. May, comptroller the Connecticut Company, New Haven, Conn.; Vice-President, John Lindall, superintendent of rolling stock and shops, Boston Elevated Railway; Joseph S. Goodwin, manager Bridgeport division, the Connecticut Company; T. H. Kendrigan, superintendent and claim agent, Manchester & Derry Street Railway, Manchester, N. H.; S. S. Nicholson, vice-president Rutland Railway, Light & Power Company; Alfred Sweeney, general manager, the Androscoggin & Kennebec Railway, Lewiston, Maine, and Walter C. Slade, superintendent of power and lines, the Rhode Island Company, Providence; secretary, John W. Belling, Boston, Mass.; treasurer, Fred F. Stockwell, Cambridge, Mass.

Comparison of Costs of Heating Rivets

THE Berwick Electric Rivet Heater Company has given out some costs for heating rivets by various means which were compiled from tests made in its own plant. The company states that from 12 to 14 gal. of fuel oil is required to heat 100 lb. of rivets. At a cost of fuel oil of 6 cents a gallon delivered in the plant tanks, the cost of heating is from 72 cents to 84 cents per 100 lb. of rivets. To this must be added the maintenance cost of three furnaces, rebricking, etc., amounting to 2 cents per 100 lb. Where coke is used for fuel, it requires approximately 135 lb. of coke to heat 100 lb. of rivets. With coke at $7.80 per ton delivered, the fuel cost is 45 cents per 100 lb. of rivets, to which must be added 25 cents for carrying the coke to the furnace and removing the ashes, plus also a 2-cent maintenance charge. The total heating cost is 72 cents per 100 lb. of heated rivets. The cost of heating rivets with coal is approximately the same as that with coke.



HEATING RIVETS IN AN ELECTRIC HEATER

It requires approximately 432 cu.ft. of gas to heat 100 lb. of rivets, so that with gas at 70 cents per 1,000 cu.ft. plus a maintenance charge of 4 cents there is a total of 34 cents per 100 lb. of heated rivets.

For heating rivets by electricity approximately 20 kw.-hr. is required to heat 100 lb. With electrical energy at 1¼ cents per kilowatt-hour the cost is 25 cents per 100 lb. of heated rivets. The maintenance cost of an electric heater, as judged by the experience of the company over a period of five years, is very small, consisting only of wear on the copper electrodes and contacts.

The accompanying illustration shows the type of electric rivet heater which has been placed on the market by this company. The heaters are constructed with several types of electrodes to meet various conditions.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Labor Not a Commodity

Report of Industrial Conference Reflects Increased Respect in Which Labor is Now Held

The President's Industrial Conference has reported. It proposed to the President and to Congress a national system for dealing with industrial disputes based on three cardinal principles which were recognized by the conference in forming its conclusions. These are:

WORKERS HAVE RIGHT TO STRIKE

1. That labor is not a commodity, but a human relation which must be adequately organized.
2. That workers have a right to strike. In recognition of this, the conference refused to recommend legal prohibition of strikes.
3. That adjustment of the grievances of any group must be made in co-operation with the other party to the dispute. This principle is recognized in all the machinery recommended by the conference.

The report is a document of 20,000 words. It goes into every phase of labor relations and conditions of employment. Its most significant recommendations are for:

1. Establishment of employee representation in shops or plants.
2. Acceptance of the principle of collective bargaining.
3. Creation of machinery for settlement of all industrial disputes.
4. A new system of food marketing and development of co-operative buying and selling of food products to stop speculation and profiteering.
5. Fixing of a minimum wage to give reasonable living conditions and protect community and individual from the ill effects of lack of competence.
6. Extension of Government machinery to investigate living costs.
7. Establishment of "gain-sharing" as opposed to profit-sharing.
8. Promotion of the insurance principle and for converting Liberty loan savings into some form of annuities.
9. Fixing hours of labor on a weekly basis, with preferably forty-eight hours a week and a Saturday half holiday.
10. Final determination of hours of labor on the basis of studies of fatigue and the effect of work in a particular calling on the one hand and studies of hours that will give maximum production on the other.
11. Prevention of child labor and enforced schooling and physical upbuilding.
12. Special safeguards for women in industry as to hours and conditions of work, and equal pay for equal skill and production.
13. Better housing.
14. Prevention of labor turnover.
15. Relief from present economic conditions for Government workers and school teachers.

PROFIT SHARING NO PANACEA

The report opposes:

1. Profit sharing as a panacea for labor ills.
2. Restriction of production by labor.
3. Strike by United States employees or public servants, such as police and firemen.
4. Affiliation of policemen and firemen with organizations that use the strike weapon.
5. Encouragement of overtime work.

As applied to public utilities other than railroads under the Esch-Cummins act, the report provides that a regional board shall have only one panel member on each side, while two members shall be appointed by the Government authority or commission authorized to regulate the utility in which the dispute arises. The unanimous findings of such a board are morally binding upon both parties to the dispute unless disaffirmed in writing within specified periods. Appeals to the national board in utilities cases are to be decided by majority vote (including one of the public members). Mr. Gregory and Mr. Stuart, of the conference, were in favor of making strikes in essential industries unlawful, but the majority were unwilling to go so far.

10 Per Cent Wage Increase in Pittsburgh

All employees of the Pittsburgh (Pa.) Railways working on an hourly basis are to get a wage increase of 10 per cent, effective on April 1. Charles A. Fagan, S. L. Tone and W. D. George, the receivers, made this announcement on March 18. About 7,000 men, chiefly manual workers, are affected. The increase will cost the railway about $1,000,000 additional annually.

Patrick J. McGrath, secretary of the union, declared that the receivers' 10 per cent increase will have no effect upon the demands about to be made by the motormen and conductors for more wages. These demands, he declared, will be pushed. He said:

> We received notice of the 10 per cent increase and it was read at the meetings of the men last night and to-day. No action was taken on it, of course. We were informed the receivers intended to put the increase into effect and we have no objections to their plans. Our agreement with the receivers expires on April 30. Under that agreement each side must give notice of changes desired a month before the expiration of the agreement. We will give such notice about April 1, unless the receivers ask an earlier meeting. We will not announce publicly what we are going to ask for until we have first submitted it to the receivers.

Changes in certain working conditions also will be demanded by the men. The 10 per cent wage increase will give them a minimum pay of 58.3 cents an hour and a maximum of 62.7, against 53 and 57 as at present. It is understood that the men will demand 15 per cent more.

Last April, when the receivers failed to meet the demands of the men, a strike resulted, paralyzing the entire electric transportation system of Greater Pittsburgh for three days and causing a loss to mercantile and other interests of upward of $10,000,000.

Elsewhere in this issue extended reference is made to the report of the Public Service Commission with respect to fares in Pittsburgh and to the value of the property as found by the commission.

Will Discontinue Park

Company at Fort Wayne Finds Automobile Keen Competitor and Operating Cost Prohibitive

Robison Park, for a quarter of a century the recreation point for citizens of Fort Wayne, Ind., is to be closed. This has just been announced by the Indiana Public Service Corporation, owner of the property. Last year was the biggest the park has ever had in point of attendance and receipts.

Robert M. Feustel, president of the corporation, in announcing the intention to sell the buildings and ground and junk the 7-mile double-track line to the park, declared that the park had never paid and that it is out of the question for the corporation to continue the operation of the resort. Mr. Feustel said:

> The railway has had no real choice in the matter. The company's open cars are no longer in condition to operate. The company feels that real protection to its patrons is the first consideration and so does not care to risk the lives of patrons on the old open cars. Regarding the earnings side of the matter the story at Fort Wayne has been the same as with all other electric railway parks over the country where a long haul was made over a route which was not used all the year round in regular service. These parks have never paid. Last year the total receipts from the car operation were $28,498, which was about 18 cents per car mile of operation. This cost barely paid the wages of trainmen and actual power costs. It left nothing for car or track maintenance and other miscellaneous expenses.

SOME TRAFFIC FIGURES

During the past six years the earnings of the park line together with number of passengers carried have been as follows:

CAR MILES OPERATED—1914, 137,546; 1915, 111,359; 1916, 139,134; 1917, 120,044; 1918, 135,523; 1919, 153,788.

PASSENGERS CARRIED ON CARS—1914, 178,472; 1915, 120,391; 1916, 170,909; 1917, 167,284; 1918, 162,322; 1919, 197,232; Total, 996,610; average per year, 166,102.

TOTAL EARNINGS—1914, $24,765; 1915, $16,644; 1916, $22,158; 1917, $22,461; 1918, $24,910; 1919, $28,498.

TO PARK IN AUTOMOBILES—1914, 20,861; 1915, 22,133; 1916, 34,187; 1917, 46,796; 1918, 44,218; 1919, 57,491.

TOTAL AT PARK—1914, 199,330; 1915, 142,524; 1916, 205,096; 1917, 214,080; 1918, 206,540; 1919, 254,723. Grand total, 1,222,296; average per year, 203,716.

It is estimated that the replacement value of the thirty or more buildings at the park, the double-track line, etc., is close to $500,000.

Fort Wayne will not be without an amusement park during the coming summer, as George F. Trier, who conducted the dancing pavilion at Robison Park, has organized a $200,000 company to erect and operate an amusement park just beyond Foster Park at the edge of the southern city limits and within a short walking distance of the Broadway line of the Indiana Public Service Corporation.

Mr. Doherty Ready to Sell to City

Will Accept $11,000,000 for Railway Property at Toledo, With Discount for All Cash

The commission appointed by Federal Judge Killits to draw up an ordinance providing for the municipal ownership of the railway system of Toledo, Ohio, has been busy making preliminary inquiries. The members asked Henry L. Doherty what his price would be on the lines, asked for legal aid from the city law director and Mayor Schreiber, and solicited the co-operation of a subcommittee of the Council.

Offer to Sell Was Telegraphed

Mr. Doherty wired from New York that his engineers determined the value of the property at $16,000,000, but that he would take $11,000,000, 20 per cent cash and the remainder in first mortgage bonds. He also indicated that he might discount this sum for a total cash purchase price. The city's valuation figures were $7,111,000. Mr. Doherty's answer to Mayor Schreiber's question directed by the commission was as follows:

> I have discussed with my associates a sale price for the railway properties. We feel that under the federal decisions we are entitled to present value of the inventory property. This, according to our engineers, would be approximately $16,000,000, which we can substantiate by competent and reputable experts in this line. According to the Goodwillie commission the property showed a value in excess of $12,000,000.
>
> Your telegram does not say in just what manner you purpose to make payment, but as you had previously expressed the desire not to use the entire debt power of the city I assume you will want to pay about 20 per cent in cash and the balance in bonds.
>
> To secure a settlement of the matter we would be willing to take $11,000,000, but would, of course, prefer to have cash and would discount the above if the city should desire to make entire payment.

Ready to Accept $2,200,000 Cash

Mr. Doherty has not yet given an answer to the Mayor on what his discounted price would be.

The appraisal of the property by Service Director Goodwillie, Prof. Riggs of Ann Arbor and Frederick W. Ballard of Cleveland, which was accepted by the service-at-cost commission and which some of the municipal ownership commissioners believe is too high, can be successfully defended in court, the experts declare.

Mr. Doherty's price of $11,000,000 would indicate that he regards the price of $7,111,000 as below what might be secured on the bonds in the open market. He proposes to accept a cash payment of $2,200,000 and first mortgage bonds for the balance of $8,800,000. These bonds then would have the railway property as their only security.

The commissioners have proposed condemnation through court proceedings since the receipt of Mr. Doherty's price. The Mayor and legal experts are preparing the plan of operation for the commissioners to carry out. They have made little progress thus far on account of the fact that there is no precedent in Ohio for the condemnation of a railway property and very little precedent anywhere for condemnation of public utilities.

The commissioners have indicated that they might not wish to recommend the purchase of the entire system, but that some of the lines ought to be abandoned and others re-routed, supplemented, possibly, by a bus system.

"If the city was dealing with a man for any other property and he made a reply like Mr. Doherty has sent, I am sure the city would cease to negotiate and proceed to condemn," declared Henry W. Ashley, chairman of the municipal ownership commission.

The city has been asked to look into the matter of "damages" to which the company would be entitled if not all the lines were bought by the city.

Chairman Ashley declared in a meeting of the commission that he had secured legal advice that the company would have no claim to damages if the city took only parts of the present system.

While the municipal ownership commission is battling to draft an ordinance to submit to the people at the same time that the cost-of-service measure is up for ratification, the cost-of-service commission is waiting the written objections and suggestions for improvement of their document from Henry L. Doherty and the company.

It is thought that both measures may be ready to submit to the people at one election about June 15.

The Worst Is Over

Stone & Webster Look for Continued Betterment of Conditions Affecting the Public Utilities

Stone & Webster have prepared an analysis of conditions in the public utility field which sounds one of the first optimistic notes heard since the beginning of the war. They summarize general conditions as follows:

1. Electric light, power and gas companies have demonstrated an ability to readjust rates and operating conditions to offset increases in operating expenses and continue a satisfactory return on the investment.

2. Street railways are gradually but more slowly readjusting rates and methods of operation, and promise ultimately as satisfactory results as those which have been obtained by electric light and power and gas companies.

3. Present indications all point to the conclusion that operating costs in 1919 reached approximately the highest point to which they will be carried by war conditions.

4. Improved methods of operation are introducing economies which will at least partially offset increases in costs of labor and materials.

5. There is a constantly increasing demand for public utility service of all kinds, including the service of street railways. This is reflected by constantly increasing gross earnings.

6. Improved operating conditions existing or in prospect have not yet been reflected in security values.

Recent Public Utility Financing

The engineers state that more money was raised for public utilities last year than in the six years since 1913, and present the following table to show what proportion of the financing was done through the medium of bonds, notes and stocks in that period:

	Bonds	Notes	Stocks
1914	$196,000,000	$107,000,000	$43,500,000
1915	149,000,000	137,000,000	38,000,000
1916	383,000	114,000,000	43,000,000
1917	148,498,200	145,645,600	69,069,470
1918	167,395,000	261,563,900	22,044,750
1919	272,335,300	252,408,500	66,108,890

The analysis also says that figures showing what proportion of this financing was for purposes of refunding and what for new construction were not available, but that "it is certain that the demand for increased service and consequent additions to plant is constant and of large volume."

With regard to the street railways Stone & Webster say in part:

> Street railways obviously have suffered more than other public utilities from conditions brought about by the war. In most cases the problems involved do not, however, differ fundamentally from those of other utilities; they are simply more difficult and require longer to work out because of the long established precedent of the 5-cent fare.
>
> ### The Street Railways
>
> The exhaustive investigation and study given to the street railway industry during the past two years is making it constantly clearer that the question involved in most cases is solely the need for an equitable readjustment in the rate of fare to offset the decreased value and purchasing power of the nickel. In most cases the railway is not asking an increase in fare in terms of commodities. Its needs will be fully met by receipt of a fare having a purchasing power in other commodities equal to that formerly possessed by the nickel.
>
> When the nominal rate of fare is increased, there is usually some reduction in volume of riding. This is due in part to a feeling of misunderstanding toward the railway and in part to a natural but mistaken feeling on the part of the rider that the car fare in relation to his income has increased and that he cannot afford to pay this increase; that this reduction in riding is temporary and will gradually disappear as the situation is better understood is already evident. In cities where an increase in fare has been in effect for a reasonable period, the riding per capita is gradually returning to its normal pre-war basis.
>
> As will be shown in figures later in this statement, much progress already has been made in bringing about a flexible and adequate fare system, and when the readjustment of fares now in progress is completed we may expect financial results as satisfactory as those which have already been brought about in other branches of the public utility industry. As this takes place street railway securities should gradually increase in value and again be recognized as one of the most desirable forms of investment.
>
> ### Railway Service Essential
>
> A complete and unified system of transportation is an essential of urban life without which the business and other activities of the communities must cease. That such a system, to give adequate and satisfactory service, must depend primarily upon the use of tracks in public streets, on elevated structures or in subways, we firmly believe. On this obvious need for service and on the material progress which has already been made toward readjustment of the fare system we base our optimism for the future of this business.
>
> During the year a most complete investigation of the street railway industry has been made by the Federal Electric Railways Commission appointed by President Wilson. The report of this commission has not yet been made, but its broad activities in accumulating information and in holding hearings has been very helpful

in securing recognition of the need for a general fare readjustment to enable the industry adequately to serve the public.

PROGRESS IN FARE INCREASES

We give below statistics indicating growth in recent months in the number of cities in the United States in which higher railway fares have become effective:

	May 1 1919	Jan. 1 1920
No. of cities in U. S. paying 10-cent fare	29	59
No. of cities in U. S. paying 9-cent fare	0	1
No. of cities in U. S. paying 8-cent fare	19	21
No. of cities in U. S. paying 7-cent fare	100	147
No. of cities in U. S. paying 6-cent fare	164	185
	312	413

These figures mean that a population amounting to more than 33,000,000 is paying higher fares. The total population served by the street railways of the country, including the interurbans, is approximately 45,000,000. In other words, about 70 per cent of the people in the United States served by such railways are now paying higher fares.

STREET-CAR RIDING CONSTANTLY INCREASING

There is an impression on the part of some people that the street railway business has been seriously affected by the automobile. Although this may be true in the case of some street railway mileage serving scattered communities, an analysis of companies under the management of our organization operating in cities, widely distributed geographically, indicates that while the population of the cities served increased from 1,247,800 in 1909 to 1,776,300 in 1919, or 42.3 per cent, the actual riding has increased approximately 77 per cent, or an increase in per capita riding of 24.3 per cent. In other words, each person in 1909 averaged 108.6 rides per annum and each person of the larger population in 1919 averaged 135 rides per annum. This undoubtedly can be taken as a fair index of the street railway industry as a whole, and shows that along with the growth in the use of the automobile there has been a steadily increasing demand for street railway service during the last ten years. The street car, in short, is more than ever the people's vehicle.

THE ONE-MAN SAFETY CAR

The use of this type of car has proved to be most important in reducing expenses which helps to offset the unavoidable increase in the cost of labor and material.

While the safety car alone is not a cure-all, it comes near being such when taken in connection with recognition of the economic need of higher fares, and it will be of great benefit both to the public and the companies.

OPERATING EXPENSES

Present indications all point to the conclusion that operating costs in 1919 reached approximately the highest point to which they will be carried by war conditions. During the latter months of the year, especially, the wage situation was less acute, as evidenced by fewer strikes in the industry as a whole; moreover, the cost of materials, except for articles made up of wood, showed a tendency either to remain stationary or advance only slightly.

Stone & Webster feel confident that the public utility field at this time, after making due allowance for the present market rates for money, offers an unusual opportunity to purchase at exceptionally low prices securities of many companies which have weathered successfully the difficulties of the war period, and that the companies which have suffered most from the effects of the war will gradually readjust their affairs on a sounder basis than ever before.

The opinion of Stone & Webster in this connection is confirmed by circulars and other matter issued from other sources pointing out wherein the outlook for the industry as a whole is much improved and citing specific instances where the particular property is doing very well.

Atlanta Wage Contract Signed

The contract between the union carmen and the Georgia Railway & Power Company, Atlanta, Ga., for 1920, covering wages and working conditions, has been formally signed. It provides that the wage scale recently decided upon by a board of arbitration shall be retroactive to Jan. 1, 1920. The new scale grants a 15 per cent increase in wages. Dissatisfaction with the terms that have now been accepted resulted in the recent strike.

Additional terms of the contract give the company the privilege of maintaining an open shop, though it is agreed that any of the motormen or conductors may join the union if they so desire, and that there shall be no discrimination on the part of the company for or against any employee because he may be a member of the union. It is also provided by the 1920 contract that any disputes which may arise between the company and the men shall be settled by a board of arbitration and that the decision of this board shall be final.

In the current issue of *Two Bells*, a weekly paper published by the company, it is pointed out that the increase of 15 per cent granted the carmen provides annual salaries ranging from about $1,550 to about $2,015, while the average pay of Atlanta policemen and firemen is only $1,380 a year. Last year the railway employees received from $1,350 to $1,750. It is further pointed out for the edification of the general public that the lowest paid motormen and conductors under the old scale of pay received about as much as the average firemen and policemen of the city, while under the increase that has been granted the railway men will receive considerably more than the classes of public servants which have been mentioned.

The average pay of motormen and conductors who worked twelve hours per day last year was $1,680. This year the average for the same hours will be $1,872.

As this average is slightly in excess of $35 weekly, the company points out in the current issue of *Two Bells* that motormen and conductors have no cause for complaint. Public opinion in that respect is with the company.

Danbury Road Hard Hit by Fire

The Danbury & Bethel Street Railway, Danbury, Conn., has been hard hit by the fire which destroyed its carhouse. So far as the building and several of the cars are concerned the company's loss was small, but the loss of eleven open summer cars is severe. These cars were income producers during the summer season and came in very handy during the week of the Danbury Fair. They were old cars, but they answered the purpose of the company. J. Moss Ives, the receiver, has already ordered six safety cars. The company was insured, but it is doubtful if it can get present-day valuations for its rolling stock; that is, replacement value. These cars were not worth much on the market, but they were worth a great deal to the company. It is said that the receiver will make an effort to secure some second-hand open cars from the Connecticut Company, as that company cannot use open cars to advantage with its new zone system.

Wages Increased in Los Angeles

The Pacific Electric Railway and the Los Angeles Railway Corporation announce substantial increases in pay of trainmen, effective on April 1. The increases on the Los Angeles Railway Corporation's Los Angeles city lines apply to motormen and conductors. On the Pacific Electric Railway's city and interurban lines the increase in pay will affect motormen, conductors, brakemen, switchmen, trolleymen and yard foremen. The raise schedule for the Los Angeles Railway Lines is as follows:

First three months' service, new rate of pay 44 cents per hour; next nine months, 46 cents per hour; second year, 47 cents per hour; third year and thereafter, 49 cents per hour. Additional wages for one-man car operators are scheduled in addition to the above raises and are as follows:

On Main Line cars, 4 cents per hour additional wages are given above the rates of pay so increased in the general service. On shuttle cars, 2 cents per hour additional wages.

The rates of pay of motormen and conductors in train service on the Pacific Electric Railway are as follows:

STREET CAR SERVICE

First three months	44 cents an hour
Next nine months	45 cents an hour
Second year	46 cents an hour
Third year	47 cents an hour
Fourth year and thereafter	48 cents an hour

INTERURBAN SERVICE

First three months	46½ cents an hour
Next nine months	47½ cents an hour
Second year	48½ cents an hour
Third year	49½ cents an hour
Fourth year and thereafter	50½ cents an hour

ON SINGLE TRACK INTERURBAN LINES

First three months	49 cents an hour
Next nine months	50 cents an hour
Second year	51 cents an hour
Third year	52 cents an hour
Fourth year and thereafter	53 cents an hour

FREIGHT AND WORK TRAIN SERVICE

Motormen	(Flat rate)	57 cents an hour
Conductors	(flat rate)	57 cents an hour
Brakemen and switchmen	(flat rate)	52 cents an hour
Trolleymen	(flat rate)	47 cents an hour
Yard foremen	(flat rate)	57 cents an hour

On the Pacific Electric Lines the above rates will apply, and in addition thereto the annual twelve days' vacation with full pay will be continued, no option being allowed with reference to this vacation.

In addition, the granting of passes for meritorious service and other pass concessions will continue in effect as covered by the company's "Rules Governing Transportation." Furthermore, passes will be issued to employees who may live on the lines of the Pacific Electric, for travel to and from their work, as has been the practice since June, 1919.

This increase alone on Pacific Electric Lines will amount to approximately $170,000 additional per annum.

The two companies operate 1,480 miles of electric railway.

Participating Profit Certificates for Employees

Railway President Announces Profit-Sharing Plan Different from Most Proposals of the Kind

David I. McCahill, Pittsburgh's young lawyer-traction official, plans to distribute $1,000,000 of common stock among the 400 or more employees of his Pittsburgh, Butler & Harmony Consolidated Railway & Power Company and its subsidiaries and to give them representation on the board of directors. Mr. McCahill believes that by making his employees a "part of the works," he is improving their financial and social condition, and at the same time making more money for his company. Aside from taking his employees into the company, Mr. McCahill has provided many other benefits for them, such as old-age pension and sick and death funds.

Six Trainmen Become Directors

The election of six trainmen to the board of directors will likely take place next week. Three men will represent the so-called Harmony road and three the Mars road. Mr. McCahill suggested that the men nominated be indorsed by at least twenty other employees and requested that the names be placed in the hands of the superintendent of the company not later than April 1.

Announcement of his intention to do these things was made by Mr. McCahill. H. E. Etheridge, vice-president in Butler, Pa., the Northern terminus of the line. He arranged two get-together dinners—one at 11 o'clock in the morning for the night shift, and the other at 7 o'clock in the evening for the day shift. Mayor Heineman of Butler presided at the meetings. Judge Reiber, of the Common Pleas Court of Butler County, praised the plan and told the trainmen they ought to be very thankful to have the opportunity that was being provided them by Mr. McCahill. H. E. Etheridge, vice-president and general manager of the traction interests, also was one of the speakers.

Profit Plan Outlined

The plan suggested for allowing the employees to share in the net profits of the properties was outlined by Mr. McCahill as follows:

A block of the common stock of the holding company, approximately $1,000,000, face amount, will be set aside under a trust agreement with some bank or trust company, such stock to be held in trust by such depositary and any dividends declared thereon to be distributed to the employees in accordance with profit certificates which would be issued to each employee who has been in the service of the company for a period of at least a year. The fund which would result from dividends being declared on the common stock so held in trust would be divided equally between all the employees entitled to share therein as above mentioned, so that each employee would be interested in holding down the number of employees to as few as possible, because the greater the number of employees the less amount each would receive as his proportionate equal share of the dividends declared into this fund.

The certificates would entitle the holder to his proportionate share of the dividends during the time he remained in the employ of the company, but if at any time he should leave the employ of the company, either voluntarily or upon request, the certificate would be forfeited, and his rights thereto would cease.

In case an employee died while in the service of the company, his widow, during her lifetime, and after her death any minor children he might have, would be entitled to his share in the fund. Upon the death of such minor children, or, if there be no minor children, upon the death of the widow, or, if there be no minor children nor widow upon his death, the certificate would be cancelled and his interest would lapse.

The right to vote the common stock so held in trust would remain with Mr. McCahill and his associate, Mr. Etheridge.

In order that the employees might have representation even greater than that which they would have if they had full voting power on the common stock, not less than three employees would be elected to the board of directors of the Harmony Road and the Mars Road, these directors to be selected by the men themselves, according to such rules as they may adopt, subject to the approval of Mr. McCahill and Mr. Etheridge, as to fairness. As directors these men will have full voting power on such boards. This will give a greater representation on the board of directors of each of these roads than could be secured by voting the common stock which would be placed in trust direct by the employees.

Mr. McCahill proposes to make the plan effective for a trial period of five years. Every employee will be entitled to share in the plan.

Details of Securities Outstanding

The Pittsburgh, Butler & Harmony Consolidated Railway & Power Company has issued and outstanding $1,800,000, par value, of 6 per cent cumulative preferred stock and $4,500,000, par value, of common stock. It owns $2,745,000, par value, of common stock of the Pittsburgh, Harmony, Butler & New Castle Railway, out of a total of $3,000,000, par value, of stock issued and outstanding. This company is known as the Harmony Road. The Harmony Road owns all of the $25,000, par value, of the common capital stock of the Harmony Electric Company, issued and outstanding. The Harmony Road also owns all of the capital stock of the Ellwood Koppel Bridge Company.

The holding company also owns $95,500, par value, of the capital stock of the North Pittsburgh Realty Company, out of a total of $164,250, par value, of stock issued and outstanding. The holding company also owns $999,500, par value, of the capital stock of the Pittsburgh, Mars & Butler Railway, out of a total of $1,000,000, par value, of stock issued and outstanding by that company. This company is known as the Mars Road. The total indebtedness other than debts for current operating expenses is as follows:

The Harmony Road, $2,900,000 first mortgage 5 per cent bonds, due 1936, $176,000, face amount, demand notes.

Ellwood Koppel Bridge Company, $150,000 first mortgage 5 per cent bonds due 1943.

Mars Road, $900,000 first mortgage 6 per cent bonds due 1946.

North Pittsburgh Realty Company, approximately $100,000, face amount, demand notes in addition to certain purchase money mortgages secured by mortgage on the respective parcels of land purchased.

A conservative estimate of the present value of the property of the entire system owned by the various companies above mentioned is between $8,000,000 and $8,500,000.

Large Detroit Registration

Municipal Ownership Issue Stirs All Detroit to Action—Lively Campaign in Progress

The number of voters registered in Detroit, Mich., up to the closing date on March 20 indicates that a large ballot will be cast on the proposal of the city to spend $15,000,000 in starting a municipal railway. From the large registration, it appears that the people intend to follow out Mayor Couzens' admonition to vote. The Mayor, on several occasions, stated that the small vote cast on former occasions was a great disappointment to him.

The settlement ordinance containing the counter proposal of the Detroit United Railway for extensions was returned to the company by Corporation Counsel Wilcox, who stated his reasons for not approving the ordinance as to form.

Among the reasons enumerated was the claim that the title of the ordinance was misleading in that it did not state that the instrument was a thirty-year franchise, which the Corporation Counsel believes it to be. Failure on the part of the company to list in detail all the lines which it now operates, failure to state whether the company was a corporation, a partnership or an individual, lack of definition of terms as to what were to constitute operating expenses, maintenance items, depreciation and other lawful expenses, and lack of stipulation of a penalty to be imposed on the company for failure to operate city built subways and elevated lines, were enumerated as flaws in the ordinance.

Mandamus proceedings were instituted by the Detroit United Railways to compel the Corporation Counsel to approve the company's initiatory ordinance. A hearing on the mandamus action will probably be held before a court of three circuit judges. In the meantime petitions are being circulated among the proponents of the company's plan to obtain the required number of signatures.

A committee of citizens has been organized who are opposed to municipal ownership to endeavor to defeat the Mayor's plan.

Mayor Couzens maintains that the Detroit United Railway will be forced into a transfer agreement when the city lines are in operation, but the company states that it will not be possible for the people to avoid paying two or more fares with two systems operating, whereas one fare would be charged under a unified system.

Abner E. Larned, Sydney D. Waldon, and Francis McMath, former members of the Street Railway Commission, state that 7 to 10 cent fares will be necessary if the piece-meal plan is carried out. They also state that even if the

Detroit United Railway is forced in the end to grant concessions, the surrender will come after a "siege of litigation," during which there will be no transfer interchange.

In regard to the assertion that the city can prevent interurban cars coming into Detroit until the Detroit United Railway grants the transfer privilege, it is asserted that aside from the ability of the Detroit United Railway management to dodge trouble through use of trackage still within its control, the business of the city would be impeded and action would be taken by the Michigan Railway Commission in case the municipal government interfered with the free play of intrastate commerce.

John C. Frost, general manager of the Detroit Elevated Corporation, announced to the City Council his willingness to build a trial crosstown elevated line on approval. No action, however, was taken on this proposal.

Electrification Rumor Unfounded

There is no basis in fact for the report from Pittsburgh that the Pennsylvania Railroad is taking preliminary steps at this time looking toward the electrification of the Pittsburgh, Fort Wayne & Chicago division, although the railroad, for a number of years, has realized that ultimately it will be advisable to install electricity at a number of points on the system in addition to those where such power has already been adopted. As is well known the road out of New York is electrified between the Pennsylvania Station in New York City and Manhattan Transfer, just outside of Newark. This stretch takes in the Hudson Tubes. The company has also electrified the suburban portion of the main line between Broad Street Station, Philadelphia, and Paoli, and between Broad Street Station and Chestnut Hill. These are two sections of extremely heavy commutation travel.

It is realized that it would be desirable in a similar way to electrify the suburban zone around Pittsburgh, also to electrify between Philadelphia and Wilmington, through the tunnels at Baltimore and over the mountain grades just west of Altoona. A further development would complete the electrification from New York to Philadelphia, and Philadelphia to Washington. All of these matters have been talked about for a number of years. There is nothing new to report regarding them at this time. The company is not prepared to go ahead at present or in the near future with any of these projects, and there is no likelihood that the work near Pittsburgh will be executed soon.

Capital Traction Increases Wages

The Capital Traction Company, Washington, D. C., on March 19 granted its motormen and conductors an increase of 5 cents an hour and a 10 per cent increase in pay to all other employees, effective on March 31.

The new wages of the trainmen will be: For the first three months of service, 51 cents an hour; for the next nine months, 54 cents, and after a year, 56 cents. The men asked for 65 cents an hour. The present rates are: For the first three months, 46 cents; for the next nine months, 49 cents, and after a year, 51 cents.

The new wage rates are part of a new agreement entered into between the company and Division No. 689 of the Amalgamated Association. The new agreemeent is to remain in force until March 30, 1923, with the provision that either side may move to change the wage scale at the end of each year upon giving thirty days' notice.

In the new agreement the District Commissioners no longer are designated as arbitrators of disputes which the company and the men cannot settle in conference. Under the new plan there will be a board of arbitration composed of three men—one chosen by the union, one by the company and the third selected by these two to represent the public. If after five days the first two arbitrators have failed to name a third to represent the public the Commissioners will be empowered to name him.

News Notes

Wage Offer Rejected. — After two hours of discussion on March 3 the trainmen in the employ of the Dubuque (Ia.) Electric Company refused to heed the plea of their president, C. C. Mead, to accept a temporary compromise wage offer, and taking the situation in their own hands called a walkout.

Twelve Per Cent Wage Increase.—The Harrisburg (Pa.) Railways has increased the wages of its trainmen and other employees. The increase will total $70,000. It became effective March 15. The new scale for trainmen is 48 cents an hour the first year, 49 cents an hour the second year and 50 cents an hour the third year and thereafter. The increase is approximately 12 per cent over the scale that has been in effect.

Want Wage Increase in Winnipeg.—A sub-committee of the union of employees of the Winnipeg (Man.) Electric Railway has been working for some time on a proposed revision of wages. It is said that an increase from 60 to 80 cents an hour will be asked. The present rates are from 39 to 55 cents an hour. Better working conditions and shorter hours are also among the concessions to be asked. The program as thus outlined is of course subject to approval by the entire union.

Wage Demands Threaten Life of Suburban Line.—The employees of the New Jersey & Pennsylvania Traction Company, Trenton, N. J., have presented demands for a wage increase of 25 per cent to take effect by April 1. Gaylord Thompson, general manager of the company, has issued a statement to the effect that if the new wage scale is insisted upon the company will be forced out of business. In the new contract the men ask $1 an hour for operating one-man cars; 60 cents for motormen and conductors and double pay for Sundays and holidays.

New Franchise Proposed in Lima.—Prospects appear to be good for negotiations to commence soon for a new franchise for the Ohio Electric Railway in Lima, Ohio. Attorneys for the joint committee of citizens have prepared a tentative franchise. This has been presented to the City Council. It is said that except for a few minor changes the proposed new grant will be presented to the railway just as received from the committee. The Council is said to be opposed to one-man cars. James B. Dugan, resident manager of the railway, says the company is ready to proceed with the negotiations.

Trial Operation by City Suggested.—Elton S. Wilde, vice-president and general manager of the Union Street Railway, New Bedford, Mass., told a councilmanic committee recently that the six months' agreement under which the company is maintaining service between Lunds corner and Sassaquin is about to expire and when it does the company will be willing to furnish power and the cars and let the city operate the line. Under the present arrangement the city pays $200 a month to the Eastern Massachusetts Street Railway for the rental of the tracks and whatever revenue there is goes to the Union Street Railway.

Back to Private Life.—F. H. LaGuardia, president of the Board of Aldermen of New York, in an address to the New York Board of Trade and Transportation, said in regard to the local transit matter: "No matter how this question is decided, the men who decide are politically dead. I expect to go back to law practice in two years. We don't need any legislation. What we need is management, and above all we need a higher code of ethics, a better realization of duty to the public that is served. The whole trouble has been one of management, and to put it mildly the management has been rotten."

Program of Meeting

National Immigration Conference

A national immigration conference will be held on April 7 in New York City in the Engineering Societies Building, 29 West Thirty-ninth Street. National leaders in American industry and finance will discuss the shortage of foreign-born labor and the loss of production due to unrest among the workers, and measures will be taken for united action to relieve this condition. Further details may be secured by addressing Coleman du Pont, chairman of the board, the Inter-racial Council, 120 Broadway, New York.

Financial and Corporate

Two Reorganization Plans

Drastic Cuts in Fixed Charges Are Proposed in Tentative Rhode Island Proposals

Two plans have been presented for the reorganization of the electric railways in Rhode Island controlled by the Rhode Island Company. One plan represents the ideas of the receivers of the United Traction & Electric Company and the Rhode Island Suburban Railway. The other plan represents the ideas of the committees acting for the bondholders of these companies. Both plans call for a material reduction in the fixed charges of the companies. The plans differ in their essentials, however, and it is said that little hope exists of the differences being ironed out. This is purely a matter of unofficial information.

Proposals Only Tentative

As for the plans themselves there would appear to be little reason at this time to go into the proposed basis of the exchange of securities. The proposals are only tentative. Moreover the likelihood of the failure of the present Legislature to enact favorable permissive measures may alter the situation materially.

The plan outlined by the receivers is addressed to Governor Beeckman. The purpose of this plan is to assure a comprehensive system of transportation under one company, which shall operate all of the properties heretofore operated by the Rhode Island Company. The plan contemplates private management under state supervision. It recognizes the necessity for fixing the capitalization of the new company on a conservative basis, and for making provisions for present financial needs and future development of the properties. It calls for $2,000,000 in new money for rehabilitation.

Revenue Requirements Small

The fixed charges to be paid out of annual revenue are reduced to a minimum. To accomplish this result the plan provides that all accrued interest on present securities be forfeited; that 4 per cent bonds be issued in exchange for the existing 5 per cent bonds of United Traction & Electric Company; that the Rhode Island Suburban Railway bondholders take stock in exchange for $500,000 of their present bonds, and that the United Traction & Electric Company stockholders receive $7,000,000 par value stock in exchange for their existing $8,000,000 stock of the Traction Company.

It is the opinion of the receivers that the lower revenue requirements provided by this plan constitute an element of safety and go far to insure the success of the reorganization. The plan seeks by this means to avoid the necessity of raising fares in the future.

The receivers are in accord with the views heretofore expressed by the Governor that relief from taxation should only be granted as part of a plan which provides for contribution by the holders of existing stock and bonds. It is for this reason, as well as to insure the success of the reorganization, that they have provided for the material contributions on the part of holders of existing stock and bonds. The plan is conditioned upon the passage of the remedial legislation for which it provides. It is pointed out that without such legislation it is not possible under present revenue conditions for a reorganization to succeed.

The plan advanced by the security holders also provides that representatives of the various classes of security holders and of the public are to be associated in the management of the company. There will be a single new company with $22,600,000 of securities outstanding. The success of the whole structure is presaged on the company obtaining suitable legislation.

Plea for Bondholders' Plan

Stephen O. Metcalf of the committee representing the bondholders of the United Traction & Electric Company said for this plan that the generous scaling down of the securities of each class and the greatly reduced fixed charges over any other plan yet submitted should recommend it to the public. That the plan in this respect is drastic is instanced by the provision that the holders of the United Traction & Electric Company and the Rhode Island Suburban Railway shall forego the defaulted interest on their bonds to the amount of $1,200,000. In addition to this, to cite another example, the holders of the bonds cut their principal $1,400,000 and receive $1,400,000 in common stock. Under the plan of this committee the reorganized company would obtain $1,000,000 in new money.

Preferred Dividend Passed

Owing to the expense entailed by the severe storms and the extremely cold weather of the past winter, the New Brunswick Power Company, St. John, N. B., has been compelled to pass the dividend on its preferred stock. The heavy February storms completely interrupted the railway service for several days, and also damaged the electric light and power distributing systems. The total loss will aggregate $40,000. The narrow margin afforded by the rates allowed prevent the company from accumulating a surplus adequate for such contingencies.

Financing Plan Changed

$4,000,000 Loan Renewed — Dividends Passed Will Be Applied to Its Liquidation

The directors of the Northern Ohio Electric Corporation, Akron, Ohio, have decided that the amount and number of subscriptions received to Class A 8 per cent first preferred stock were insufficient to justify their acceptance and that the plan for the readjustment of the finances of the company referred to in the ELECTRIC RAILWAY JOURNAL of Jan. 24, page 215, be abandoned. This action was taken after conference with and approval of the bankers holding the $4,000,000 loan which it was sought to retire.

Loan Will Be Extended

It is announced that the company has arranged with the banks for an extension of the loan for one year and has agreed with them that dividends will be deferred until such time as financial conditions will permit the sale of securities to retire the loan. The company will apply the equivalent amount of such dividends to the reduction of the principal.

The directors felt that under the circumstances the best interest of all the stockholders was being conserved by this course. The preferred stock dividends are cumulative and the directors have every confidence that the accumulations will be paid in full. It is explained that every dollar applied to the liquidation of the loan places the stock in that much stronger position. The sum of $100,000 has been paid on account of the note and like payments will be made quarterly. This amount is approximately the equivalent of the 6 per cent dividend on the preferred stock.

The loan of $4,000,000 made by the Northern Ohio Electric Corporation became due on Feb. 1. It was proposed to liquify the loan through the issue of $4,000,000 of Class A 8 per cent first preferred stock. The present 6 per cent preferred stock was to have been exchanged for new Class B 7 per cent preferred stock, providing the holder subscribed for 66⅔ per cent of Class A preferred at par and also paid $10 per share held for the privilege of the exchange.

The loan which it was proposed to take up was made at the time of the original financing of the company in 1916. At that time the issuance of $6,000,000 of preferred stock, 75,000 shares of common stock without par value and a $4,000,000 one-year loan provided for the purchase of approximately $9,000,000 of common stock of the Northern Ohio Traction & Light Company and also furnished about $900,000 of working capital. This one-year loan was secured by a pledge of the Northern Ohio Traction & Light Company common stock purchased. It has been renewed from year to year owing to the unfavorable financial condition attributable to the war.

Norfolk Adopts Broad Policy Toward Public Utilities

City Council and City Public Utilities Commission Unanimously Agree to Safeguard Capital Both as to Principal and Return

In what will probably prove a noteworthy example, and an outstanding leading case, the City of Norfolk, Va., acting first through its Public Utilities Commission and second through its Council, has adopted a definite policy of encouraging public utility development in that city. The platform or principle is that "Capital legitimately invested in public utility properties must be safeguarded and protected by municipalities, both as to principal and as to a just and inviting return thereon after reimbursement to the company for expenses incurred in providing service."

City Advocates Square Deal

This was unanimously adopted by both bodies. In other words, the city has definitely gone on record that it believes in dealing in a business-like manner with those business undertakings which are known as public utilities. It guarantees safety and an adequate return to money invested in developing public utilities and thus hopes to encourage capital to undertake that development and benefit therefrom.

The particular case which caused this action is one in which the City Gas Company of Norfolk, included in the system of the Virginia Railway & Power Company, petitioned for an increase of gas rates from a base rate of $1.20 per thousand cubic feet to $1.60. Norfolk is fortunate in that the five men who compose its City Council are apparently foresighted, broad-gage business men who deal with the city's interests in a business and not political manner. The same type of men are on its Public Utilities Commission.

The commissioners frankly admitted their own lack of familiarity or expertness in the public utility business, and in order to secure data upon which they could give a fair judgment they called in A. Merritt Taylor as a person mutually satisfactory to the city and the company. Mr. Taylor's former experience as Transit Commissioner of Philadelphia, as manager of the Division of Passenger Transportation and Housing of the Emergency Fleet Corporation during the war and as a public utility builder and operator encouraged them to believe he could advise intelligently with the various interests involved.

Valuation Scaled Down

With his associate, Charles B. Cook, Mr. Taylor made a valuation of the gas property, scaling down from an apparent book value of $3,603,203, the company's valuation, to $2,383,908, a figure finally agreed upon by the Public Utilities Commission, the gas company and Mr. Taylor.

In 1896 the two gas companies then in Norfolk merged into the present company, the valuation at that time being placed at $971,621. Since about $500,000 of this amount represented stock for which no cash or equivalent had been advanced, other data tending to show that the actual fairly invested capital in 1896 was just under $500,000, that figure was adopted as a base.

Historical Investment $1,421,690

Actual additions, subsequent to 1896, were established and a total historical investment of $1,421,690 was arrived at for the property as of January, 1920. This basis was used in contradistinction to the company's contention for present-day high prices. This figure does not include going concern, land increments and working capital. The final valuation was arrived at as shown by the following figures:

Total historical cash investment, January, 1920	$1,421,690
Going concern value (15 per cent of above item)	213,000
Increment in land value as determined by appraisal committee appointed by city and company	488,660
Total property value, Jan., 1920	$2,123,350
Working capital	130,000
Additional investment now being made	130,558
Total value for rate base	$2,383,908

Upon this base, a return of 8 per cent cumulative was set up and adopted as a part of the city policy of guarantee to the company. This means 34.6 cents per thousand cubic feet of gas. A detailed analysis of the cost of producing gas showed $1.294 per thousand, thus making a price of $1.640 legitimate. The company's request of $1.60 was thus substantiated and allowed by the city. However, it was agreed by the city and company that variations in price of oil used in gas manufacture would cause corresponding variations in the price of gas to the consumer.

No Figures in Refutation

From the reports of the various steps in the proceedings, the Council and Public Utilities Commission maintained an attitude of fairness to the utility, at the same time conserving the city's interests in the broadest possible manner. There was some objection at times by some members of the Chamber of Commerce, but the Public Utilities Commission took the attitude that the Chamber's representatives were very tardy in presenting their views, not appearing until a vote was to be taken. No figures were presented to refute the conclusions of the commission, Council and Mr. Taylor.

The company was criticised for the dirty and rundown condition of portions of its plant, but this condition was found to be due in part to causes beyond the company's control and the company promised immediate attention to the plant to put it in first class order, showing evidence of much already done in that line.

While there are many more details of the situation of special interest from the gas standpoint, the chief interest to all public utilities lies in the fundamental principle adopted by the city as to its attitude toward such business. Whether this attitude will be recognized and sustained by the State Corporation Commission remains to be seen. The City Council has authorized the chairman of the city's Public Utilities Commission, the city attorney and Mr. Taylor to submit a copy of Mr. Taylor's report to the State Corporation Commission when it hears the case on March 29. They are also authorized to present the city's resolution upholding the report with its platform and valuation as representing the viewpoint of the city and the manner in which the city desires to treat and deal with public utilities within its borders.

Valuations Under Way

Valuations are now being conducted of the railway properties of the company in Norfolk. It is expected that the data in connection with these cases will be ready for presentation within sixty days. In this instance also Mr. Taylor has been retained by the City of Norfolk.

Receiver for Chicago Ten-Cent Bus Line

United States Judge K. M. Landis has appointed the Central Trust Company of Illinois receiver for the Chicago Motor Bus Company following the filing of the bill of complaint by New York holders of $150,000 of bonds of the company. Counsel for the petitioners said that the bonds were due in January, 1920, but were not taken up by the company at that time. The Chicago Motor Bus Company has been operating a 10-cent motor bus service on the north side of Chicago along the Lake Shore and through Lincoln Park.

In spite of the rosy predictions of those who financed the company, hearings held before the Public Utilities Commission of Illinois in May, 1919, revealed that the company was having difficulties in making bare operating expenses. The facts were developed in the competition for motor bus franchises on the south side between the Chicago Motor Bus Company and the Chicago Stage Company. In a decision handed down Jan. 20, 1920, the commission criticized the methods of the Chicago Motor Bus Company and granted the desired franchises to the Chicago Stage Company. In the hearings in May, 1919, it was contended that high maintenance expenses, which were responsible for deficits, would be reduced sufficiently to permit operation at a profit if the company could operate additional buses on the south side. The commission, however, was not satisfied with the method of financing the company or the design of the coach proposed.

Mr. Mitten Increases Net

Philadelphia Rapid Transit, With Its Nickel Fare and Three-Cent Transfer Does Increased Business

That the methods employed by the Philadelphia (Pa.) Rapid Transit Company in conducting its business have proved beneficial not only to its investors but to its patrons is reflected in the annual report just issued covering the year ended Dec. 31, 1919.

Passenger revenue for the year increased 13.64 per cent over the previous year and represented 96.5 per cent of the gross earnings. The number of passengers transported to give this revenue was 723,610,228. Operating expenses, however, increased 22.82 per cent, due to the increased wages paid in the transportation department, so that the increase in net operating revenue was only 1.108 per cent. Maintenance and renewals amounted to $5,766,322, equivalent to 16.32 per cent of the railway operating revenue. In other words, this charge was more than $10,000 per annum for each mile of route now in operation. Deferred maintenance of the war-time period has largely been caught up by the use of reserves established for this purpose. The increase of 6.97 per cent in general expense is due mainly to settlements for the larger number of accidents occurring during the war-time period.

Deductions from gross income increased $106,098. These deductions now represent 27.55 per cent of the total railway operating revenue. This increase is caused mostly by the payment of interest on passenger cars secured by lease from the United States Government. The net corporate income increased slightly, being 11.79 per cent over the previous year, and is equivalent to a 5.72 per cent return on the $29,991,660 of outstanding capital stock, as against 5.12 per cent in 1918. Two semi-annual 2.5 per cent dividends were paid during the year.

Rentals paid for leased lines were 1.875 per cent greater than in 1919 and were equivalent to 15.2 per cent over the total funded debt of $57,073,425 of the twenty-eight leased lines. Taken as a whole the capitalization of the Philadelphia Rapid Transit System amounts to $86,453,040 in stock and $42,653,867 in bonds. The total rentals, dividends, interest, etc., paid on these securities represents a return of 8.6 per cent on the $129,106,907 of securities outstanding.

The accompanying tables give in detail the income account and statistical information concerning the traffic handled.

INCOME STATEMENT OF THE PHILADELPHIA RAPID TRANSIT COMPANY

Year ended Dec. 31	1919	1918	Per Cent Change + Inc.—Dec.
Gross passenger revenue	$34,739,589	$30,568,788	+ 13.64
Other operating revenue	618,882	515,025	+ 20.17
Total railway operating revenue	$35,358,471	$31,083,813	+ 13.75
Way and structures and equipment — maintenance and renewals	$4,707,012	$3,780,800	+ 24.47
Power—maintenance and operation	3,450,486	3,319,199	+ 3.96
Conducting transportation	11,387,653	8,923,021	+ 27.62
General	2,697,091	2,088,218	+ 6.97
Total railway operating expenses	$22,242,242	$18,111,238	+ 22.82
Net operating revenue	$13,116,229	$12,972,575	+ 1.108
Taxes including paving tax	$2,345,750	$2,428,819	— 3.42
Operating income	$10,770,479	$10,543,756	+ 2.15
Non-operating income	$681,049	$620,614	+ 9.74
Gross income	$11,451,528	$11,164,370	+ 2.57
Interest	$927,926	$981,652	— 5.38
Rentals	8,687,725	8,527,902	+ 1.875
Sinking fund—city contract	120,000	120,000	..
Total deductions	$9,735,651	$9,629,554	+ 1.102
Net corporate income	$1,715,877	$1,534,816	+ 11.79

STATISTICAL INFORMATION OF THE PHILADELPHIA RAPID TRANSIT COMPANY

	1919	1918	
Average total miles operated	671.42	661 45	+ 1.51
Surface	648 09	638 12	+ 1 56
Elevated	16 71	16 71	.. ..
Subway	6 62	6.62	.. ..
Revenue car miles to car hours—speed in M.P.H.	9 07	8 77	+ 3 42
Revenue passengers, at 5 cents	672,021,657	593,494,427	+ 13 25
Revenue exchange passengers, at 3 cents	51,588,571	43,791,710	+ 15 12
Total revenue, passengers	743,610,228	637,286,137	+ 13.52
Free transfer passengers	149,145,171	130,472,269	+ 14.35
Total passengers handled	872,755,398	767,758,406	+ 63 64
Gross passenger revenue	$34,739,589	$30,568,788	+ 13 64
Average fare:			
Per revenue passenger (cents)	4 81	4 79	+ 0 417
Per total passenger (cents)	3 98	3 98	
Revenue per mile of track	$51,800	$46,200	12 10
Operating revenue — per cent	63 0	58 2	
Taxes — per cent of gross revenue	6 52	7 67	

Common Dividend Resumed

New Jersey Company Votes 1 Per Cent for First Quarter of New Year—Railway Doing Better

The directors of the Public Service Corporation of New Jersey, Newark, N. J., have authorized the payment of $500,000 in dividends on common and preferred stock for the first three months of 1920. Although a return has been paid regularly in the past on preferred, the 1 per cent declaration voted on common stock is a resumption of payment after the passing of the dividend for the last three months of 1919.

Lowest Rate Since 1909

Two per cent for the quarter year will be paid on the $10,000,000 of preferred stock outstanding and 1 per cent is authorized on the $30,000,000 common stock.

The payment of a 1 per cent dividend, or at the rate of 4 per cent for the year on common stock, while a resumption of payment, is at the lowest rate the company has paid since 1909. Last year, with three quarterly payments, the total for the year was 4½ per cent. Dividends have been paid since 1907.

The first increase over 4 per cent was in September, 1909, when the rate was made 1½ per cent quarterly. The following year 6 per cent was paid and in 1915 another quarter per cent was added to the annual return. In 1916 7¾ per cent was paid, followed in 1917 by 8 per cent. In 1918 the yearly return dropped to 6 per cent.

After the meeting Thomas N. McCarter, president of the company, issued the following statement:

After full consideration of all the circumstances of the corporation's affairs the board of directors of the corporation felt it to be proper to resume the payment of dividends to the extent of a quarterly declaration of 1 per cent upon the common stock of the corporation.

The electric company and the gas company are now functioning properly and making satisfactory earnings. The railway company, as is well known, has been allowed a rate sufficient to keep it going; that is to say, to enable it to pay its operating expenses and fixed charges. The rate does not provide sufficient revenue to yield any substantial return upon the investment of the corporation in the railway's stocks.

This situation, it is expected, will be cured during the next few months. The railway company, too, has suffered from excessive operating expenses caused by the abnormal weather conditions of the present winter.

Outlook Growing Better

The early months of the year are relatively lean months in the public utility business, the larger profits being made in the latter part of the year. The showing, however, of the corporation, as a whole, for so much of the year as has elapsed is so satisfactory and the estimate of the earnings for the year is so promising that the directors felt justified in taking the action above set forth.

The pending quarter will be only the second time in the history of the corporation that a dividend declared at this season of the year will have been earned by the corporation in the specific quarter to which the dividend is applicable.

It is expected that the detailed report of operation of the company for the year will be available for publication soon.

Wheeling Lines Foreclosed

The West Virginia Traction & Electric Company, Wheeling, W. Va., and all its holdings were bought in by the first mortage holders of the concern at public auction at Wheeling on March 15. G. H. Walbridge, representing the bondholders' protective committee of New York, was the only bidder. He paid $760,000 for the property.

The property was first offered for sale as a whole. The bid was $750,000. The property was then divided in parcels and each sold singly. The Morgantown property was first offered. Mr. Walbridge bid $700,000. The next parcel was the holdings in Wheeling, for which the same bidder offered $50,000. The third bid was $10,000 for the 495 outstanding shares of the City & Suburban Gas Company.

A reorganization is probable and new corporations will be formed to conduct the business. The bondholders were represented by G. H. Walbridge and Attorney Gerrard Glenn. Receiver Whittemore and Attorney J. J. Coniff looked after the company's interests.

Snow Cleaning Cost $221,000

For the period ended with Feb. 20, 1920, the cost of snow removal for the entire system of the Eastern Massachusetts Street Railway, comprising about 780 miles of track, the expenditure for labor alone was $221,000, or an average of about $333 per mile. The highest cost per mile was $568, for the Salem district. The lowest cost per mile is $181 for the Taunton district.

The additional cost of rehabilitation of the rolling stock together with maintenance will bring the total for this period up to about $500,000.

The crippling of traffic due to the fall of snow, more than 35 in. for the Massachusetts district, reached an acute stage. On March 1 only two lines of the entire system were running 100 per cent service. These lines were the Lynn and Lawrence divisions.

The conditions early in March were so bad that it was expected it would take some weeks before normal service could be resumed.

Rainier Valley Value $765,760

W. H. Moore, a Councilman of Seattle, Wash., appointed by the City Council to investigate the value of the Seattle & Rainier Valley Railway, has submitted a report to the utilities committee. He has placed a value of $765,760 on the properties. This does not include a sum the company spent in raising tracks and filling right-of-way to the present grade. This sum will be added as soon as it has been estimated.

It is uncertain whether the report by Mr. Moore brings the matter of the purchase of the lines by the city any nearer to consummation, as E. W. Sampsell, president of the company, has refused to negotiate on the basis of the report. An appraisal of the property made in 1913, when the city contemplated the purchase of the road, fixed the value at $1,264,072. In 1918 Mr. Sampsell offered to sell the Rainier Valley lines to the city for $1,600,000. Shortly after the city of Seattle purchased the railway lines of the Puget Sound Traction, Light & Power Company the Seattle & Rainier Valley line secured permission from the State Public Service Commission to raise its rates to 7 cents. This resulted in a movement on the part of residents of the Valley to induce the city to purchase the system.

Wants Bridge Traffic Restored

Deputy Public Service Commissioner Morgan T. Donnelly of the First District is making an effort to get surface line traffic restored across the Williamsburg Bridge. He has held hearings relating to this subject and has also conferred with representatives of the New York Railways and the Fourth & Madison Avenue Railroad for the purpose of learning what is the attitude of the operators of those lines toward the resumption of service across the bridge. The so-called green car lines carried about 20,000 passengers daily in rush hours to and fro across the Williamsburg Bridge previous to the elimination of the service. The Brooklyn Rapid Transit surface lines operating across the bridge carried about 16,000 persons daily in the rush hours previous to the elimination of green car service, and have carried about 15 per cent additional since that time, while there has been a large diversion of traffic to the Brooklyn Rapid Transit elevated and subway lines which run over the bridge. The hearings will be resumed and Commissioner Donnelly will endeavor to determine what actual steps can be taken to restore service.

Charlotte Suburban Line Sold

The Charlotte (N. C.) Rapid Transit Company, which went into the hands of a receiver in 1918, has recently had its last effects sold at auction. These consisted of 2 miles of track and trolley, with some additional poles, ballast material and other supplies. The property mentioned was bid in by Paul Chatham, former president of the company, at $10,000.

The Charlotte Rapid Transit Company was organized ten years ago with a capital of $75,000. It began operation in 1911 of a storage battery car from the end of a line of the Southern Public Utilities Company, which operates the railway in Charlotte, to the country club. The storage battery service was not a success and in May, 1913, the Southern Public Utilities Company began the operation of cars over the Rapid Transit line under a contract with the latter company. This service was discontinued on May 19, 1918, because the owners of the suburban line were not able to meet the deficit incurred through the operation of cars over the line.

For the past two years a considerable residence addition at Chatham Estates and Chantilly has been without railway service. It is reported that residents of that section will endeavor shortly to take over the effects of the defunct company from Mr. Chatham and enter into a new contract with the Southern Public Utilities Company for the operation of cars over the line. The latter company is now using one-man safety cars on some of its lines in Charlotte, and it is believed that through the operation of such cars and with increased patronage there will be little if any deficit on the line now abandoned.

Financial News Notes

Increase in Chicago City Dividend.—The Chicago (Ill.) City Railway has declared a quarterly dividend of 1¼ per cent, payable on March 31 to stock of record March 25, thus placing the stock on a 6 per cent basis. The former basis was 5 per cent.

Two New Directors Elected.—Stockholders of the Dallas (Tex.) Railway met recently for the annual election of officers. J. T. Owens and Sam P. Cochran, both of Dallas, were elected directors to fill vacancies caused by the resignations of F. B. Bissell and LaMonte Daniels.

Suspension of Service in Weymouth.—The Eastern Massachusetts Street Railway has suspended indefinitely all service in the town of Weymouth, Mass., in consequence of the refusal of the town authorities to furnish financial aid in meeting the expense of maintenance and operation.

Service Suspended.—The Albany (Ga.) Transit Company has reduced service to a single car. Complete suspension and the junking of the line are threatened. It is said that the principal owners will sell for $45,000. The suggestion has been made that the city take over the road and operate it.

Abandonment Threatened. — The Bridgeton & Millville Traction Company, Bridgeton, N. J., has threatened to abandon the road and tear up the tracks if forced by Common Council to pay a share of an extensive street paving program. Members of the Council will confer with the traction officials in an effort to adjust the matter.

Fights for Present Worth Ruling.—The St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo., has petitioned for an injunction in the United States Court to restrain the Missouri Public Service Commission from basing the valuation of the railway properties on the initial cost instead of on present worth in determining a basis for establishing equitable rates. The company states that its

properties are now worth $11,000,000, as compared with a valuation of approximately $5,500,000 fixed by the commission.

Appraisal for Nashville.—Prof. Albert S. Richey of Worcester, Mass., has been retained by the Tennessee Railroad & Public Utilities Commission to represent it in an appraisal of the property of the Nashville Railway & Light Company. Robert M. Feustel, consulting engineer, Fort Wayne, Ind., has been retained by the company as its representative. The city of Nashville has not yet indicated whether it will appoint an engineer to represent it in the appraisal. The order of the commission makes it optional with the city as to whether it will or will not join in the work.

Long Island Line Ordered to Resume.—Deputy Public Service Commissioner Alfred M. Barrett of the First District has directed the New York & North Shore Traction Company, operating in the northern portion of Queens, to resume service immediately. The company shut down several weeks ago, when its tracks were blocked with snow and ice, and it became impossible for the company to obtain funds to clear them sufficiently to resume operation. The company has replied that it is now endeavoring to obtain $20,000, which it believes will be a sum sufficient to put its tracks and equipment in proper shape to restore service.

Public Utilities Doing Well.—Continued progress is reported by the utility companies included in the Cities Service Company, New York, N. Y., these properties not only reporting the largest gross revenues in their history but also showing improvement in net revenues. From present indications 1920 will be the greatest year from the viewpoint of net earnings in the history of the public service division. The demand for central station electric power at all properties controlled by Cities Service Company continues unabated and if these demands are to be met much additional generating equipment must be installed at the central station properties.

Interest Payments Authorized.—Interest amounting to $190,200, due on April 1, 1920, on the company's general mortgage 4½ per cent refunding bonds will be paid by Lee C. Bradley, receiver for the Birmingham Railway, Light & Power Company and the Birmingham Tidewater Railway. Judge William I. Grubb, of the United States District Court, rendered a decree March 18 authorizing the receiver to pay the interest due on April 1 and authorized him to pay such instalments of the company's Federal income tax as are due. The receiver was also authorized to extend for a period of not more than six months receivers' certificates when they become due and payable.

Hyde Park Line to Discontinue.—Corporation Counsel Arthur D. Hill and Assistant Corporation Counsel Joseph P. Lyons, representing the city of Boston, have informed the trustees of the Eastern Massachusetts Street Railway that the city does not intend to aid the road financially so that its lines in Hyde Park can continue operating. As a result of the disclosure of the city of Boston's position, the trustees say that it will be necessary to discontinue all service in Hyde Park on April 1. The State Department of Public Utilities has recommended that the Boston Elevated Railway take over the lines which the Eastern Massachusetts Street Railway has announced it will abandon.

Short-Term Notes Offered.—Ames, Emerich & Company, New York, N. Y., are offering for subscription at 98½ and interest, yielding 7.80 per cent $850,000 of two-year 7 per cent secured gold notes of the Richland Public Service Company. The company is a subsidiary of Cities Service Company. It owns or controls and operates the only electric light, power and street railway system in Mansfield, Ohio, the interurban railway between Mansfield and Shelby and one of the two gas distribution systems supplying natural gas, principally for domestic use, in Mansfield, and is also furnishing electric current to the local company at Ashland for distribution by it. The notes are dated March 15, 1920.

Representatives of Bankers in Charge.—Charles Day and John E. Zimmerman, Philadelphia, Pa., will become managers of the Ohio Electric Railway on April 1, according to announcement made by F. A. Healy, secretary and treasurer of the company. Mr. Healy said no change will be made in the personnel of officers and employees of the company. H. Gordon Gilpin will retain his position as general manager and Mr. Healy will remain as secretary and treasurer. Mr. Healy said that the bankers and bondholders' protective committees have agreed with President W. Kesley Schoepf that the company should be turned over to Messrs. Day and Zimmerman, to be managed by them as the bankers' representatives.

Pittsburgh Doing Better.—An investment banking circular reviewing the affairs of the Philadelphia Company, which controls the Pittsburgh Railways, says: "The ownership of the Pittsburgh Railways, heretofore treated by the company as a non-revenue producer, has great possibilities of developing into a source of income, as cash fares have been increased from 5 cents to 10 cents. The company sells tickets also at the rate of four for 30 cents. The gross receipts have thus increased from about $32,201 a day in 1914 to about $58,700 a day in 1919. The company now is understood to be earning all of its fixed charges. The valuation placed upon the transit system by appraisers indicates that the time is not far distant when under the caption of 'Other Income' will be listed the revenues from the Pittsburgh Railways."

Two New Directors in Philadelphia.—William J. Montgomery and William Y. Tripple have been elected directors of the Philadelphia (Pa.) Rapid Transit Company to succeed C. E. Ingersoll and J. J. Sullivan, Jr. Messrs. Montgomery and Tripple are Philadelphia Rapid Transit Company stockholders of many years' standing. They were elected as direct representatives of the stockholders, following the dissolution of the voting trust, which was made effective on Feb. 12. Mr. Stotesbury was re-elected chairman of the board and Mr. Mitten chairman of the executive committee and president. The election of W. C. Dunbar as vice-president in charge of accounting and finance and G. A. Richardson as vice-president in charge of operation was made in order that they might with greater authority assist President Mitten in the management of the property.

Bond Extension Arranged.—The Cleveland, Southwestern & Columbus Railway has arranged for the extension until Feb. 1, 1923, of the $110,000 of twenty-year first mortgage bonds of the Norwalk Gas & Electric Company, due on April 1, which issue it has assumed to pay by agreement of consolidation. The company found it was practically impossible at the present time to refund the bonds in the ordinary way and that the only course available was to provide for a short extension. The bonds will accordingly be extended until Feb. 1, 1923, at the same rate of interest, namely 6 per cent. In consideration of this extension the company proposes to make an immediate cash payment of $14.17 on each $500 bond. Thus the bonds during the period of extension will net the holder slightly more than 7 per cent annually. The company hopes that with the continued improvement in its earnings, the most satisfactory in its entire history, and with the termination of the present stringency in the money market it will have no difficulty in paying the bonds promptly at the extended maturity date.

Referendum on Dividend Increase.—Councilman H. C. Gahn, Cleveland, Ohio, stated on March 26 that he and associates will soon file more than 6,000 additional names asking for a referendum vote on the ordinance increasing the rate of dividend on Cleveland Railway stock from 6 per cent to 7 per cent. The Tayler service-at-cost ordinance fixed the rate of return at 6 per cent, but when the trainmen were granted an increase in wages some time ago the company asked for an increase in dividends on the basis that stockholders are entitled to an additional income just as much as are the employees. Two or three weeks ago Judge Dan B. Cull held that the original petitions were not sufficient. The fifteen-day limit claimed by Mr. Gahn for securing additional names expired on March 24. City Clerk Benkoski will be asked to certify the petitions, after which Council will be requested to order the question placed on the ballots at the next election. The decision of the arbitrators permitting the increase in the rate of dividend was reviewed at length in the ELECTRIC RAILWAY JOURNAL of Jan. 3, page 71. The decision of the city to arbitrate was reached last July.

Traffic and Transportation

May Order Zone System

Washington Company's Case Before Commission—Must Have More Revenue

A zone-fare system may be introduced in Washington, D. C., as a solution of the financial difficulties of the Washington Railway & Electric Company. That such a system might be established in the national capital became evident on March 23 when the Public Utilities Commission of the District of Columbia opened hearings on the company's application for relief further than that afforded by the present 7-cent cash fare with a ticket rate of 6¼ cents.

The company now asks a flat 7-cent fare with a 2-cent charge for transfers. The application for the increase was filed with the commission early in January. At that time it was stated that the company must secure additional revenue. W. F. Ham, president of the road, informed the commission at the hearing on March 23 that during the past twenty months the company had failed to meet expenses by more than $1,000,000.

Thorough Investigation Promised

The commission announced that it would go thoroughly into the company's condition with a view to working out a satisfactory plan of operation. In this connection Commissioner Kutz stated that the board would make a study of the zone plan in order that, if found advisable, it might order its adoption by the company. He instructed President Ham, for the Washington Railway & Electric Company, and Vice-President Hanna, for the Capital Traction Company, to prepare suggestions of a specific nature regarding the possible results of the installation of a zone system.

The 7-cent cash fare with four tickets for 25 cents, has been in effect since Nov. 1, 1919. The Capital Traction Company is also charging 7-cent cash fares, but is asking no further relief. The latter company is, however, a party to the present proceedings by order of the commission.

Company's Plight Grave

Mr. Ham informed the commission that his company could not long continue to provide the present standard of service unless it were granted further relief. He went over the road's financial condition in detail and presented figures to show that during the past twenty months the company had furnished service at a loss of $1,147,960. During the fourteen months previous to Nov. 1 the road rendered service at $936,565 less than cost. Mr. Ham called the commission's attention to the fact that the company had passed both its common and preferred stock dividends, and that its 6 per cent bonds were now on a 12½ per cent basis. He stated that the company was facing default on the mortgage bonds of the City & Suburban Railway and that the officials had almost reached the limit of their ability to keep the system together.

President Ham then presented figures of the company showing a comparison of earnings for the company immediately prior to and immediately following the last raise in rate, on Nov. 1. He said that following Nov. 1, the average earning was slightly more than $14,000 per day, whereas during October the average earning of the company was slightly less than $12,800 per day.

Falling Off in Car Riders

He presented a mass of detailed figures showing the combined averages of the Capital Traction Company and the Washington Railway & Electric Company with regard to pay passengers and transfers, tending to show the falling off of gain in passenger traffic following the raise in rates.

One of the strongest points presented by the company was a table of statistics showing the operations of the Washington Railway & Electric Company for four months ending Feb. 29. The total operating income for the system, including subsidiaries, was placed at $1,779,404, and the operating expenses, taxes and miscellaneous items were figured at $1,594,413, leaving a balance of $184,990 available for the return upon investment, without payment of interest on bonds or dividends upon common or preferred stock.

Commission Hearing on Railroad Crossing Protection

The Railroad Commission of Wisconsin will hold a hearing in Madison, Wis., on April 9, for the purpose of determining whether or not it should issue an order prescribing trolley guards and other protective devices at all grade crossings of steam and electric railroads. The commission has received a number of informal complaints about the absence of trolley guards at such crossings and the question has been emphasized by several accidents occurring during the past year.

The commission's staff has studied the matter and has come to the conclusion that conditions warrant the establishment of a general rule in this connection. It will be the purpose of this hearing to afford an opportunity to the public, electric railways and steam roads to present their views on the subject.

Higher Fare Certain

Federal Court Authorizes Binghamton Receiver to Apply to Commission for Six-Cent Rate

Higher fares for the Binghamton (N. Y.) Railway are assured. Judge George W. Ray of the United States District Court on March 17 issued an order granting W. G. Phelps, receiver for the road, permission to apply to the Public Service Commission for the Second District for authority to raise the rate from 5 cents to 6 cents. The Binghamton City Council had previously passed an ordinance authorizing the increase, following the refusal of the company's carmen to return to work until the municipal government had acted favorably on Mr. Phelps' application for a fare increase.

Since the City Council has already sanctioned the 6-cent fare, the Public Service Commission is expected to give its assent to the increase without further delay. Mr. Phelps has announced that as soon as the commission has issued its formal order, he will begin carrying out the terms of the ordinance passed by the City Council.

Will Raise Wages

These call for the purchase of additional equipment, including fifteen new cars, and for other improvements in service. They also provide for an increase in wages as demanded by the men. It is believed that the additional revenue to be derived from the 6-cent fare will prove adequate to meet the expense to be incurred by the company in making the contemplated changes.

The company has been endeavoring to secure an increase in fare for many months. The City Council refused to pass an ordinance suspending for the duration of the war and for two years thereafter the franchise provision limiting the fare to 5 cents. Receiver Phelps then applied to the Federal District Court, alleging that there was in existence no contract between the company and the city limiting the rate of fare which might be charged by the former. The city objected to the jurisdiction of the court to determine this question. The court sustained the city's contention and refused to intervene.

Hard Fight for Increase

The company then sought the aid of the State Courts in an effort to secure a fare increase from the Public Service Commission. Justice Charles E. Nichols of the New York Supreme Court handed down an order last November restraining the commission from granting the company a higher fare on the ground of lack of jurisdiction growing out of the fare provision of the road's franchise. The company then turned once more to the City Council. Affairs were brought to a crisis by the demands of the men for an advance in wages. Mr. Phelps announced that under the present fare the company could grant no further wage increase. The men struck when the City Council seemed unwilling to help the company.

Ten-Cent Fare Upheld

Pittsburgh Valuation Fixed at $62,500,000—This Is Less Than Company Asked, but More Than City Would Admit

In an opinion handed down on March 23 the Pennsylvania Public Service Commission upholds as "fair and reasonable" the present "basis" carfare of 10 cents charged by the Pittsburgh Railways. The valuation of the company's properties was fixed at $62,500,000. This is $14,500,000 greater than the $48,000,000 valuation contended for by the city of Pittsburgh and $7,500,000 less than the $70,000,000 figure urged by the company. The company is capitalized at a total of $156,000,000.

Financial Reorganization Necessary

A complete financial reorganization of the company is declared necessary by the commission. Ten million dollars is set as the sum necessary for rehabilitation of the lines and rolling stock.

A physical valuation of the railways company properties, in order to determine a fair valuation, and therefore fix a fair rate of fare, was ordered by the commission, through Chairman Ainey, a little more than two years ago. In charge of an engineering board of five members, headed by Dr. F. Herbert Snow, chief engineer of the commission, as chairman, and including J. A. Emery and Morris Knowles, representing the traction interests, and Robert M. Feustel and George W. Fuller, representing Pittsburgh and surrounding municipalities traversed by the lines of the Pittsburgh Railways, the valuation was completed late last year, and submitted to the commission. The commission said:

The complainants (Pittsburgh and other municipalities) urged a valuation of $48,000,000, while respondent (the Pittsburgh Railways and Philadelphia companies) contended for $70,000,000.

The commission is convinced under all the testimony that even if the evidence would warrant it, a valuation of $48,000,000 would defeat the very purpose which the city and other complainants have in view, to wit, the rehabilitation of respondent's property upon a new and better financial basis, and the improvement and extension of its service to properly care for the present and future needs of the city and surrounding territory.

Upon such a valuation, the receivership would no doubt continue until foreclosures of mortgages disintegrated the unified system and left the city and vicinity with a number of separately operated street railway companies, each charging fares, to care for the public. This is unthinkable, and, by this report, we believe that we have laid the foundation for all that the complainants desire or the public may require.

Transit Improvements Essential

At the risk or redundancy, but with a view of retaining the emphasis of our former statements, the commission again avers to the fact that the most important question now affecting the city of Pittsburgh, with respect to its transit problems, is improvement in street railway service; that improvement cannot be secured except by the expenditure of a large amount of money, a part of which, at least, would represent new capital requirements and a portion to be devoted to replacements of tracks, acquiring new equipment to take the place of some that must be superseded. In reaching its conclusion, the commission has at all times had these matters in mind, and its final determination is made with that end in view. It recognized the difficulties in the way of accomplishment, and that conditions which arose in former years are not easily overcome or set aside.

A program by which the amount required might be so divided that a part would be chargeable to capital and the balance amortized over a course of years would furnish a solution. Under all the evidence of the case, and taking into consideration all the measures of value set forth in the Public Service Company law, the commission finds that the fair value of respondent's property considered as a going concern is $62,500,000.

An order will be issued dismissing all complaints in so far as they relate to the rate of fare.

Upholding the 7½-cent fare, the commission's order kills all value in rebate slips given riders under earlier changes in fare. Also the commission, noting a previous decision upheld in the courts, reiterates its right to ignore municipal franchises with the railways in which the rate of fare, usually 5 cents, was fixed in the franchises, and such franchises, where affecting the railways company, are set aside.

On the fare question, the commission, after reciting increases in fare preceding fixing of the present 7½-cent fare says:

None of the tariff changes, except perhaps the last, gave to the respondent company the gross revenue it anticipated.

The last increase in wages (not the recent one announced for April 1) of respondent's employees, made under the direction of the War Labor Board, increased the gross operating expenses of respondent by approximately $1,000,000 a year. Neither in the testimony, nor by argument, was it seriously contended by complainant that the gross revenue obtained under the last tariff, which was filed by the receivers, was more than the respondent was entitled to receive.

The engineering conference unanimously determined upon careful estimates that the operating costs, including taxes for 1920, would be $14,086,000. This estimate did not take into consideration the item for increased wages above referred to, calling for an additional expenditure of approximately $1,000,000. This amount must be added to the estimate of the valuation board.

The lowest valuation for rate making purposes advocated by any of the experts called by the complainant was $48,000,000 (the city's proposed valuation), and we fairly assume therefrom, and from all the testimony in the case, that a valuation less than that amount would be, in result, a confiscation of the respondent's property. If a 7 per cent return were allowed on that amount it would entitle the respondent to $3,360,000.

Adding this to the estimated operating expenses would make $18,446,000 as the practically conceded annual revenue requirements of the respondent. Measure against this amount is the uncontradicted testimony of witnesses as to the probable gross income of respondent from all sources during the year 1920. This amount is estimated at $17,642,601, showing a deficit in operating account on the assumed basis.

It was argued with some force that high rates of fare did not tend to increase the number of passengers carried, and that, therefore, the respondent company might make up a portion of its required revenue by stimulating the riding habit in the territory served if lower rates were charged.

While the respondent has put into effect a basic rate of 10 cents, a very large part of its patrons buy tickets (metal tokens) entitling them to ride for 7½ cents, which, therefore, is the controlling rate in the present instance.

The commission cannot say that such rate is prohibitive per se.

It would not, therefore, be justified under all the circumstances disclosed by the evidence in interfering with the discretion of the receivers appointed by the Federal Court to operate this property, as long as these rates will not provide a gross revenue larger than the respondent is entitled to receive.

The sequence of events in order to bring respondent's service to the standard of efficiency necessary to meet the public needs in the city of Pittsburgh and adjoining territory must be (a) the rehabilitation and readjustment of the company's financial relationship both with the holding company and with the underlying companies upon a basis of fair value; (b) the securing of additional moneys with which to make these improvements, to care for deferred maintenance and provide additional equipment; (c) a readjustment of some of the franchise obligations whereby the operating company may be relieved from unnecessary burdens of maintaining tracks which are not now used or which might, with propriety, be abandoned; (d) the granting by ordinance of certain privileges which would permit a better routing of cars, more expeditious and less crowded service, and all leading to economics in operation which would be reflected in reduced operating expenses and no doubt in an increase in the number of passengers carried.

To accomplish these improvements will require thoughtful and broad-minded cooperation between the municipalities and the railways company.

It was unanimously agreed in the engineering valuation board that the rate of return on its investment to be allowed the railways company would be 7 per cent.

The city of Pittsburgh will ask an immediate rehearing before the Public Service Commission of its decision fixing the valuation of the Pittsburgh railways at $62,500,000. It was announced by Mayor E. V. Babcock that if necessary the valuation will be appealed from the commission to the highest courts in the state. It is predicted that a flat 10-cent car fare will succeed the present 7½ cent fare.

Anti-Jitney Publicity

The Danbury & Bethel Street Railway, Danbury, Conn., has been publishing some excellent talks on jitney operation and competition. The following statements are from a recent advertisement in one of the Danbury newspapers:

We hear a great deal nowadays about the "trackless trolley" and how it will soon supersede the street car which runs on a track. Much of this talk is being fostered by motor bus and tire manufacturers in order to induce people to go into the jitney bus business and buy their wares. This is not the opinion of trained and experienced men who have given a life study to problems of urban transportation. It is now generally conceded by men who know what they are talking about and are not interested merely in advancing the sale of their products but in solving in a very real way the problem of transporting people through the streets of our cities by the cheapest and best method possible, that the only practicable and satisfactory method is the use of tracks.

Even Henry Ford, who a few months ago preached a funeral sermon over the trolley, has changed his mind and has become convinced that the street car on a track is an absolute necessity. His latest invention, the "gasolene street car," runs *on a track*.

Not one of the 114 experts, publicists, public officials or traction men who testified before the Federal Commission, seriously proposed a return to the independently operated stages or buses of pre-horse-car days, moving at will over the entire surface of the streets, taking their chances among other vehicles and making hopelessly unmanageable addition to the already overcongested traffic.

Do not be deceived by the half-baked and ill-considered opinions of men who tell you that in a few years there will be no street railway tracks in any of our cities. If the tracks are taken up in Danbury and Bethel it will not be because they have become obsolete as a method of transportation and supplanted by a better method, but because the people have given their support to the jitneys instead of to the trolley for the time being and compelled the receiver to discontinue service, dismantle this valuable property and sell it for junk. If the people of Danbury and Bethel are short-sighted enough to refuse to support the trolley and save it for the future, in a very short time they will regret the course they took when they realize that in other towns and cities the trolley has survived the jitney and that the people of these other communities are enjoying facilities which are denied to the people of Danbury and Bethel. Think this over.

Kalamazoo Will Vote on Seven-Cent Fare

The local railway problem in Kalamazoo, Mich., appears to be in a fair way toward settlement. An agreement has been entered into between the City Commission and the Michigan Railway which provides briefly for the suspension of the rate of fare fixed in the company's franchise and for the making of certain improvements by the railway.

To give the contract effect the matter will be submitted to the citizens on April 5 for a vote. It is proposed to permit the railway to charge a 7-cent fare, the company agreeing in consideration of this rate to create an improvement fund to be made up of 1 cent from every fare collected. Improvements amounting to $200,000 will be made. The improvement work will not, however, await the accumulation of the fund. The company will arrange to start the work immediately, financing it by obtaining a loan if necessary. The City Commission agrees to act substantially as follows:

Submit to the electors next April a proposition empowering the City Commission to suspend clauses in existing agreements with the Michigan Railway having to do with the rate of fare to be charged and to permit the company to charge a straight 7-cent fare entitling passengers to transfer privileges.

Designate two members of the City Commission to act on board of trustees, whose business shall be the establishment of trust fund to be made up of 1 cent from every fare for the making of improvements in the railway service.

Pass on construction program of company excepting so far as the Portage Street improvements are concerned, the latter being specified in the agreement.

Exercise the privilege of purchasing the company's lines, if the Commissioners see fit so to do, within a five-year period.

Terminate the agreement with the passing out of the original franchise in 1923.

The company agrees substantially as follows:

Devote 1 cent of every fare collected toward the establishment of a fund to be kept in the bank designated by the city for making of stipulated improvements.

Borrow money on the strength of the new agreement so that the improvements may be made and thirty-six new cars obtained at once, and liquidate the debt incurred out of the foregoing fund, bearing interest charges out of its own revenue.

Appoint one trustee to manage the trust fund with the two trustees designated by the city.

Proceed with construction work in Oakland Drive to the extent of $36,000, and or Portage Street to the extent of $96,000, and buy thirty-six new cars, the total program calling for an expenditure of $192,000.

Agree to sell, should the city decide to buy the lines, within five years.

The city retained Delos F. Wilcox, New York, as its consultant to advise on the railway matter.

New York Bus Rights Before Court

Federal Judge Julius M. Mayer on March 19 ordered Job E. Hedges, receiver for the New York (N. Y.) Railways, to institute legal proceedings to prohibit the operation of privately owned buses in competition with the company's lines. The company will ask that the buses be barred on the ground that they have no franchises and have failed to obtain certificates of convenience and necessity from the Public Service Commission for the First District. It is estimated that the competition of buses is costing the company approximately $34,000 monthly. E. L. Winthrop, of counsel for Mr. Hedges, told Judge Mayer that the company's cash balance amounted to $680,602, or $198,305 less than the predictions made a month ago forecast.

Acting on behalf of Manhattan taxpayers, E. L. Schafer has obtained from Justice Newburger a temporary injunction restraining the city from using an appropriation of $1,140,000 made by the Board of Estimate for the installation of additional municipal bus lines. The order was obtained on the grounds that the bus project would incur indebtedness other than for city or county purposes in violation of the State constitution; that the city has not received from the Legislature any power to use the credit, or the funds, of the city for such a purpose and that the city, as a municipal corporation, possesses no franchise to operate bus lines.

Accepts Columbus Grant

The Columbus Railway, Power & Light Company, Columbus, Ohio, on March 9 filed with the City Clerk its acceptance of the 6-cent fare ordinance recently passed by the City Council. The ordinance provides for a 6-cent cash fare for a six-year period. During the first two years the company is to sell five tickets for 25 cents and during the remaining four years six for 25 cents. Opponents of the measure have circulated petitions for a referendum on the question. The company on March 12 asked the Common Pleas Court to restrain the Columbus City Clerk from certifying the referendum petitions on the ground that they did not comply with the provisions of the law.

Transportation News Notes

Six-Cent Fare Continued.—By order of the Illinois Public Utilities Commission the 6-cent fare now charged by the Springfield Consolidated Railway will continue in effect until May 1.

Jitney Bonds in New Albany.—The City Council of New Albany, Ind., has passed an ordinance requiring jitney operators to deposit with the municipal authorities bonds of $1,000. The fare is limited to 5 cents on improved streets.

Wants City to Operate Lines.—Municipal ownership of the Phoenix (Ariz.) Railway is asked in petitions which are being circulated in Phoenix by M. J. Morley. Several thousand signatures have already been signed to the petitions.

Eight Cents in Alton.—The Illinois Public Utilities Commission has authorized the Alton, Granite & St. Louis Traction Company, Alton, to charge 8-cent cash fares and to sell two tickets for 15 cents. The present fare is 7 cents.

Six Cents in Centralia.—The Centralia & Central City Traction Company and the Centralia Traction Company, which operate in Centralia, Ill., have received permission from the State Public Utilities Commission to raise their fare from 5 cents to 6 cents.

Seven Cents in Pleasantville.—The Atlantic & Suburban Railway, Pleasantville, N. J., has received permission from the State Board of Public Utility Commissioners to raise the fare in each of its zones from 6 cents to 7 cents, beginning April 1. The company will sell tickets in strips of ten for 65 cents.

Traffic Probe in New Orleans.—The Association of Commerce of New Orleans, La., has appointed a committee to conduct an investigation of traffic conditions in that city. The committee will study the service furnished by the New Orleans Railway & Light Company and will make suggestions for its improvement.

Asks More in Shreveport.—The Shreveport (La.) Traction Company has petitioned the Shreveport City Commission for an increase in fare from 5 cents to 7 cents. The company asks that the question of amending its franchise to permit the fare to be raised be submitted to the voters at a referendum election.

Ten Cents Asked in Nashua.—The Nashua (N. H.) Street Railway has petitioned the State Public Service Commission for permission to increase its cash fare from 8 cents to 10 cents. The company hopes by raising the cash fare to increase the use of metal tokens, which it plans to sell at the present rate of five for 35 cents.

Increase on Connecticut Line.—Judge L. F. Burpee of the Superior Court has authorized an increase in the fare charged by the Hartford & Springfield Street Railway, Warehouse Point, Conn., to 10 cents in each zone. The new rate is approximately 3 cents a mile. The fare between Springfield and Hartford is increased by 5 cents.

Five Cents to Coney Island.—Fares between points in Manhattan and Brooklyn and Coney Island on the lines of the Brooklyn (N. Y.) Rapid Transit Company will be reduced to 5 cents on May 1, when the company's through rapid transit lines to the island will be ready for operation. Under the dual contracts it was provided that no more than a nickel should be charged for a continuous ride from any point in the city to the island, but the company has been charging 10 cents because it has been necessary to break the continuous ride provision by a transfer.

Oppose Fort Wayne Increase.—The City Council of Fort Wayne, Ind., has passed a resolution directing the Mayor

to take steps to prevent the Public Utilities Company, which operates the Fort Wayne city lines, from raising its fare. The company has applied to the State Public Service Commission for permission to increase the fare from 5 cents to 7 cents.

One-Man Cars in Franklin.—The Citizens' Traction Company, Oil City, Pa., has placed a number of Birney one-man safety cars in operation on its lines in Franklin, Pa. B. C. Everinghim, executive secretary of the Franklin Board of Trade, has written a letter to J. H. McClure, general manager of the company, expressing approval of the use of the cars in Franklin.

$1,500,000 Improvement Plan for Cincinnati.—Several important changes in car routing will be made by the Cincinnati (Ohio) Traction Company during the next few months. Walter F. Draper, vice-president of the company, has informed Street Railway Director W. C. Culkins that the carrying out of the company's improvement program will involve an expenditure of $1,500,000.

New Safety Campaign in Youngstown.—The Pennsylvania-Ohio Electric Company, the successor to the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, is about to engage in an intensive safety campaign. It has retained the Bureau of Safety, Chicago, to direct the work. Safety committees have been organized for the different departments, also a general safety committee.

Three Cents a Mile on Kansas Lines.—The Kansas Court of Industrial Relations, which has taken over the work of the State Public Utilities Commission, has granted the Kansas City, Kaw Valley & Western Railway, Bonner Springs, Kan., and the Joplin & Pittsburg Railway, Pittsburg, Kan., an increase in fare to 3 cents a mile. Commutation tickets are to be sold at the rate of 2½ cents a mile.

Chicago Traffic Survey Starts.—John A. Beeler, traffic expert, who has been retained by the Chicago (Ill.) Surface Lines to make a survey of traffic conditions in Chicago, has announced that he will begin his investigation of transit conditions in that city at once. Mr. Beeler will go thoroughly into the matter of car routing with a view to evolving a plan of relief in the congested sections of the city.

Paving Neglect a Misdemeanor.—The City Commission of Phoenix, Ariz., has passed an ordinance under the terms of which it will be a misdemeanor for any electric railway operating within the city limits to neglect improvements ordered by the commission. Under the ordinance failure on the part of the Phoenix Railway to comply with an order of the commission is punishable by a fine of $200 for each day the company fails to obey the order.

May Raise Dallas Fares.—An increase in revenue is necessary if the Dallas (Tex.) Railway is to take any steps to improve its service. Announcement to this effect was made recently by J. M. Everman, who has been appointed supervisor of public utilities for Dallas. Mr. Everman is understood to favor an increase in the company's fare. It is reported that he will shortly request the City Commission to grant a higher rate and at the same time to order improvements in the service furnished by the company.

Decision Against Commission.—The Court of Appeals of New York has denied the appeal by the Public Service Commission from the decision of the Supreme Court, which granted an alternative writ of prohibition preventing the commission from hearing an application of the receivers of the Manhattan & Queens Traction Corporation for an increased fare. The court stated that the order of the lower court was not appealable as a right and that the permission granted by the Appellate Division to appeal had been revoked.

Demand Utility Board's Removal.—Charges of neglect of duty and misconduct in office have been made against the New Jersey Board of Public Utility Commissioners by the Mayor and Aldermen of Jersey City. The Jersey City officials have asked Governor Edwards of New Jersey to remove the commissioners from office. The board is arraigned on eighteen counts, which seek to show that the board has failed to serve the public, has been unduly dilatory and formal, and has favored the Public Service Railway.

Wants Philadelphia Service Improved.—William S. Twining, director of city transit of Philadelphia, Pa., in a recent statement declared that the Philadelphia Rapid Transit Company would require 600 additional cars to provide service equal to that of 1914. Mr. Twining announced that he was prepared to demand the placing of many additional cars in operation, the taking over of the Frankford "L" by the company, and the utilization of streets at present unused, to relieve the congestion in the central part of the city.

Bus Lines Planned for Detroit.—The Detroit Motor Bus Company, formed in Detroit, Mich., for the operation of bus lines in that city, has now organized permanently with the following officers: President and general manager, R. W. Meade; vice-president, S. D. Waldron; secretary, Sherman D. Callender. The board of directors besides the foregoing officers, includes H. W. Alden, W. F. Evans, Edwin Denby, W. J. Kennedy and others. The company plans to establish service on one route in the near future and later to extend it to include others.

Zones for Philadelphia?—Joseph A. Lewis, president of the Cliveden Improvement Association, Philadelphia, Pa., testifying before the State Public Service Commission on March 19, declared that the Philadelphia Rapid Transit Company planned to introduce a zone-fare system in Philadelphia. Mr. Lewis asserted that the location of the conductor in the company's side-door cars indicated that the company intended to install such a system. The conductor in this type of car is stationed at the rear of the side exit. Mr. Lewis argued for a 5-cent fare with universal free transfers.

Setback for Hylan's Staten Island Plan.—Mayor Hylan's plan to operate city-owned cars over the tracks of the Staten Island Midland Railroad, Richmond Borough, New York City, has encountered an obstacle. The Mayor proposes to seize the tracks of the company, which suspended operation early in January, and to purchase twenty cars from the Emergency Fleet Corporation. Corporation Counsel Burr now informs his Honor that for him to operate cars over the Midland's tracks would violate the city's agreement with the company. The latter holds some twenty-five franchises, of which 50 per cent. provide from sixty to ninety days' grace which the company is allowed in warning before the termination of the franchises.

Urges Reduction for Regular Riders.—Lower fares for short-haul rides, retention of the present 5-cent fare for regular riders, and an increase to 6 or 7 cents in the rate paid by casual riders, are advocated as a partial solution of New York City's transit difficulties in a brief recently submitted to the Public Service Commission for the First District and to Judge Mayer of the United States District Court. The brief was prepared by William M. Speer for Elon S. Hobbs, who represents the minority bondholders of the Interborough Consolidated Corporation. Mr. Speer advocates a 3-cent fare for short rides on the surface lines. He would retain the present 5-cent fare in the shape of commutation tickets and would raise the cash fare to 6 or 7 cents.

City Loses Fare Fight.—The city of San Antonio, Tex., lost its fight before the United States Supreme Court for an early hearing of appeals brought by the city from Federal Court decrees restraining the city from interfering with the San Antonio Public Service Company in putting into effect higher fares as authorized by Judge Duval West of the United States District Court. Judge West, after a hearing before a master who made a report on the earnings of the company, held that the 5-cent fare authorized by the city of San Antonio was confiscatory, and declared that the company had the right to charge such fares as would assure an adequate return on invested capital. Acting on this decision, the company announced an increase in fares through the inauguration of the zone system. The city then sought an injunction in the Federal Courts, and being denied the relief sought, it appealed to the Supreme Court. Motions to expedite the hearing were denied by that body during the week ended March 13.

Personal Mention

Nominations for A. I. E. E. Officers

At the meeting of the board of directors of the American Institute of Electrical Engineers held in Pittsburgh, Pa., on March 12, the report of the committee of tellers on its canvass of the nomination ballots cast for candidates for the Institute offices falling vacant July 31 next was presented. As required by the constitution of the Institute, the board then selected by ballot its list of "directors' nominees," with the following result:

For president—A. W. Berresford, Milwaukee.

For vice-presidents—C. S. Ruffner, New York; E. H. Martindale, Cleveland; Charles Robbins, Pittsburgh; C. E. Magnusson, Seattle; C. S. McDowell, U. S. N.; L. T. Robinson, Schenectady.

For managers—E. B. Craft, New York; Harold B. Smith, Worcester, Mass.; James F. Lincoln, Cleveland.

For treasurer—George A. Hamilton, Elizabeth, N. J.

Bond Anderson has been appointed auditor of the Piedmont & Northern Railway, Charlotte, N. C.

Lucius S. Storrs, president of the Connecticut Company, New Haven, Conn., has been elected chairman of the public utilities section of the Connecticut Chamber of Commerce for the coming year.

Alfred S. March, a member of the New Jersey Board of Public Utility Commissioners, has tendered his resignation to Governor Edwards. Mr. March was appointed to the board by Governor Edge in 1917. He will resume the practice of law.

F. H. Hensel will on May 1 assume the duties of superintendent of the light and power department of the Wilmington & Philadelphia Traction Company, Wilmington, Del. Mr. Hensel will succeed Augustus T. Throop, who has tendered his resignation to take effect on that date.

C. W. Hardesty, traveling passenger and freight agent of the Monongahela Valley Traction Company, Fairmont, W. Va., has been promoted to the position of division superintendent with headquarters at Clarksburg, W. Va. Mr. Hardesty succeeds W. V. Neal.

W. V. Hill, formerly manager of the Washington (D. C.) office of the American Electric Railway Association, has reopened his office in the Holbrook Building, San Francisco, Cal., as manager of the California Electric Railway Association. In resuming his work in California Mr. Hill will turn his attention to the many new problems confronting the electric railways of the State. Charles L. Henry, president of the Indianapolis & Cincinnati Traction Company, has taken over Mr. Hill's duties at Washington, as announced in the ELECTRIC RAILWAY JOURNAL for March 6.

Mr. May, Club President

Comptroller of Connecticut Company Heads New England Body — Active Association Worker

The New England Street Railway Club has chosen for its president during the coming year I. A. May, comptroller of the Connecticut Company, New Haven, Conn. Mr. May's election as head of the club took place at the meeting of that body at Boston, Mass., on March 25 and 26. The nominations for president and the other officers were made on March 25 and were confirmed by the club at the banquet that evening.



I. A. MAY

In choosing Mr. May to direct its activities the club has selected a man well fitted both by natural ability and by training to carry on its work successfully. Mr. May is one of the best-known railway men of the New England section. He has for many years been identified with the club's activities, and has also taken much interest in the affairs of the American Electric Railway Association. He is president of the Accountants' Association of the national organization.

An accountant by profession, Mr. May has had a varied and interesting experience during his eighteen years' connection with street railway work. He entered the electric railway business in 1902 with the building of the Berkshire Street Railway in Massachusetts, as clerk and paymaster of the company. Two years later he joined the staff of the Consolidated Railway in New Haven. Here he handled the railway, electric light, gas and water accounts as head bookkeeper and chief clerk to the auditor. When the Connecticut Company was formed in February, 1910, the Consolidated Railway became a part of that system. Mr. May continued with the Connecticut Company. He was promoted to auditor in 1912 and in the following year was again advanced, this time to the office of comptroller, which he has since filled.

Mr. May passed the certified public accountancy examination in 1915. He is the author of "Street Railway Accounting," recognized as a standard work on accounts in the electric railway field. He is vice-president of the Connecticut Society of Certified Public Accountants. He has served as vice-president for Connecticut of the New England Street Railway Club for the past year.

George C. Towle, formerly general manager of the People's Railway, Dayton, Ohio, resigned on March 1 as manager of the Logansport (Ind.) Utilities Company. Mr. Towle entered the transportation field in 1890 in Ohio. In 1891 he was appointed master mechanic of the Allentown & Bethlehem Rapid Transit Company, Allentown, Pa. He resigned the next year to become superintendent of the Biddeford & Saco Railroad, Biddeford, Me., remaining with the company for three years. In 1895 he left railway work for manufacturing, but returned to it in 1900, when he was placed in charge of the Houghton County Traction Company, Houghton, Mich., by Stone & Webster. Two years later he was transferred by Stone & Webster to Ponce, Porto Rico, where for two years he had charge of the organization and construction of the Ponce Railway & Light Company. He then took charge of the Mattoon and Charleston properties of the Central Illinois Traction Company, Mattoon, Ill., and later of the Syracuse & South Bay Electric Railroad, Syracuse, N. Y. In 1906 he was appointed general manager of the People's Railway, subsequently receiving a similar appointment with the Springfield (Ohio) Railway. In October, 1919, he severed his connection with the latter company and in February of the present year he withdrew from the management of the People's Railway to take charge of the rehabilitation of the Logansport Utilities Company.

Obituary

Douglas M. Easton, at one time identified with the street railway industry in Massachusetts, died at his home in East Weymouth, Mass., on March 11. Mr. Easton was eighty-three years of age.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Labor Shortage Cuts Malleable Production

Brass and Bronze Castings Will Be Used in the Railway Field to Replace Malleables Wherever Possible

With the exception of light malleable castings such as are used in trolley construction and on which one prominent railway manufacturer is quoting delivery of from two to four weeks, the malleable market situation is serious. Production in this industry, which includes from sixty to seventy malleable iron foundries, is estimated to be 70 per cent of normal. Railways, unable to place requirements for malleables within a reasonable time, already have ordered certain fittings, castings, etc., to be made up of bronze or brass.

Manufacturers who are making brass and bronze castings in place of malleables are getting 25 to 30 cents per pound, which is cheaper on the average than malleable castings, which range from 18 to 48 cents per pound.

Deliveries on light malleable castings range from two to ten weeks and on heavy castings from three to eight months.

According to the American Malleable Castings Association, there is ample foundry capacity to provide for all known demands, provided labor can be obtained to operate the plants. As the labor shortage appears to be increasing rather than decreasing, no relief from present conditions can be foreseen within the next few months.

Wage Boost for Miners

Increase Amounts to 27 Per Cent to Become Effective April 1—Seasonal Buying Recommended

President Wilson has removed the regulation of bituminous coal prices to become effective April 1 and has transmitted the report of the majority of the Bituminous Coal Commission notifying the mine workers and operators that this must be the basis on which the wage settlement must be made.

The commission awarded the miners a wage increase which is on a 27 per cent basis, the 14 per cent increase of last October to come to an end March 31. The new wage is to continue for two years. In this way the wage contract is terminated in the spring rather than the fall.

In addition to the award, the majority report made recommendation looking to the storage of a minimum of three months' winter supply of bituminous coal by July 1 of each year by federal government departments, public utilities, railroads and domestic consumers; the study of the Interstate Commerce Commission of the advisability of instituting freight rates on coal lower in the spring than in the fall and winter months, and that steps be taken to minimize as far as possible car shortages in the transportation of coal.

Freight Delays Hold Up Work Schedules

Railways, Waiting for Material and Supplies, Unable to Commence Bonding and Repairing Overhead

Several railways within the past week report having received railbonds and other supplies by parcels post on account of the seriousness of the car shortage. Very heavy weather conditions have held up freight cars throughout the whole winter season, but particularly from the first of the year on. It is only now that some of them are finding their way to their destinations and helping to relieve the critical situation that exists. One manufacturer reports that of one hundred cars ordered from the railway to remove finished products from his factory, only nineteen were sent, and of this number nine were unfit for use because they leaked so badly it would have been unsafe to trust the materials to them. One company reports the receipt of rusted heating devices in a recent shipment made during a storm. It has been virtually impossible to withdraw freight cars from service for repairs because they were so badly needed. Recent orders placed with the steam road car builders promise to give some relief to this situation in the near future. With the condition of steel deliveries this relief is even more likely, because it is understood that steel for railway purposes is getting the preference over that for other industries.

Many manufacturers have resorted to express shipments, and although units have been limited to 200 lb. each, a great amount of material has been delivered in this way.

Certain railroad companies are demanding that their cars be sent back to their own lines immediately—cars which had been allotted to other lines while the roads were under government control. In cases this insistence has been so great that freight cars have gone back empty where with a little manipulation they could have picked up a load, although at a cost of a few days' further delay. This recall of cars to their home lines is undoubtedly going to cause a still greater car shortage than now exists on certain lines and divisions, but it will benefit the home lines.

Demand for Fiber Conduit Shows Increase

Mills Booked Up to Good Capacity with Prospects of an Advance in Prices

Fiber conduit has been purchased in large quantities this spring and mill capacities have been booked for many months ahead. The supply of pulp from Canada is in satisfactory condition for all requirements anticipated for the year. Conduit mills are running in a comfortable capacity, but if they are required to resort to extra shifts to supply a sudden demand during the summer it is expected that a price advance will result, possibly to the extent of 20 per cent.

Sufficient material is on hand to satisfy the orders now booked at the prevailing rate, which has held for some time. Additional business for quick delivery would require overtime labor and fresh ordering of raw materials at a rate higher than on those already laid in. Consequently it is of advantage to companies contemplating extensions wherein fiber conduit would be used to place their orders as soon as possible for shipment as far ahead as can be done, in order to get in on present prices.

It is known that some large contracts have not yet been placed which undoubtedly will have to be placed before the summer is out. At this time there is a certain amount of capacity which can be turned to shipment in five to six weeks. While the popular demand is for 3-in. conduit, there also has been good ordering of other sizes as well.

Trolley Cord Scarce

Heavy Demand for Sash Cord Cuts Down Available Supply for Railways

Bell cord and trolley cord deliveries are now four to six weeks on a fair sized order. Present stocks are practically nil, with but slight chances of obtaining anywhere near enough to fill orders now on hand.

Demands by the building trades for sash cord are partly responsible for the present shortage, as both sash cord and trolley cord are made on the same machine. Also, failure of the railroads to deliver raw materials, yarn, etc., to the manufacturers is a direct cause of lengthened deliveries.

Inquiries and orders from the railways on bell and trolley cord have assumed considerable volume of late and the manufacturers of cord are hoping to have sufficient quantities to equip

the large number of new cars which are now in process of construction in the plants of the different car builders. For maintenance needs railways must worry along with present supplies until the spring building rush is over, after which deliveries are expected to be improved.

Prices since the first of the year have advanced approximately 5 to 10 per cent on all grades. Quotations on one well-known brand are as follows: No. 8 white, 97 cents per lb., drab, $1.04 per lb., and mahogany, $1.09 per lb.

Magnet Wire Scarce

Unprecedented Condition Results in Long Time Deliveries, With No Signs of Immediate Relief

Manufacturers of magnet wire are unable to satisfy the present demand. As far as can be learned there is no mill capacity available under three months, and from that length of time it runs up to nine months in one case. Producers have been carried away by this unprecedented condition, and there is apparent no immediate relief from the situation.

In the case of the cotton-covered magnet wire the greatest factor in the shortage is the dearth of long-fiber cotton. When this supply would increase no one was prepared to say. For enamel wire there was found no particular shortage of enamel, although its price has been constantly increased by the manufacturers. The inability to turn out any more product under present capacity seems to be the main cause, with the result that the manufacturer must scan his list of orders and pro-rate the amount to be shipped to each company.

Better Packing of Supplies

Trolley Catchers and Retrievers Now Packed in Corrugated Board Cartons

Recently a manufacturer of railway supplies and accessories discovered that its trolley catchers and retrievers were not always reaching the purchaser in the best of condition. Rough handling in transit sometimes destroyed the enamel finish and the excelsior used in packing would work up inside and clog the mechanism.

Now each catcher and retriever is packed in a corrugated board carton after final inspection so that as a result the device is protected until it is placed on the cars. A label on the outside identifies the contents and it is therefore unnecessary to open the package until ready to put the retriever in service.

This package service which has been used to a great extent in other lines of business is proving very satisfactory according to reports received from electric railway men.

Rolling Stock

Danbury & Bethel Street Railway, Danbury, Conn., is reported to have placed an order for six safety cars.

Boston (Mass.) Elevated Railway is in the market for six cars for snow removal, some of which will be snowplows and the remainder snow-sweepers. Four large steel dump cars also will be ordered.

Washington Railway & Electric Company, Washington, D. C., is remodeling and will put in operation fifty summer cars. The cost per car will approximate $6,000, according to figures filed with the Public Utilities Commission, which has authorized the work.

Michigan Railway, Kalamazoo, Mich., will purchase thirty-six new cars for its lines in Kalamazoo if the voters on April 5 approve the tentative agreement between the railway and the City Commission under which 1 cent of every 7-cent fare which it is proposed to allow will be impounded to create a fund to pay for improvements to be carried out at once.

Northwestern Elevated Railroad, Chicago, Ill., has purchased two new 50-ton electric locomotives. These will be equipped with Westinghouse 567 motors which are of the same type as were specified for part of the last all-steel cars bought by the elevated line. The two electric locomotives will be used in connection with the interchange of freight between Chicago, North Shore & Milwaukee Railroad and the Chicago, Milwaukee & St. Paul Railroad.

Power Houses, Shops and Buildings

Fort William (Ont.) Electric Railway.—Plans have been prepared for an addition to and reconstruction of this company's carhouse. The improvements will cost $50,000.

Port Arthur (Ont.) Civic Railway.—A portion of the carhouse and four cars belonging to the Port Arthur Civic Railway were recently destroyed by fire. The loss is estimated at $100,000.

Montreal (Que.) Tramways.—This company will erect a sub-station at a cost of $75,000.

Cape Breton Electric Company, Sydney, S. C.—Fire recently destroyed the carhouse and two cars of the Cape Breton Electric Company with a loss of $50,000.

Track and Roadway

British Columbia Electric Railway, Vancouver, B. C.—This company plans to build an interurban line 10 miles long between Cloverdale and Blaine, B. C. A portion of the right-of-way has already been cleared and graded.

British Columbia Electric Railway, Vancouver, B. C.—The British Columbia Electric Railway will shortly double track its extension in Hastings Street East from Renfrew Street to Boundary Road, Vancouver, at a cost of $17,000.

Pacific Electric Railway, Los Angeles, Cal.—The Pacific Electric Railway has presented to the Chamber of Commerce of Wilmington, Cal., tentative plans for the installation of electric railway service in that city. The plans call for the building of a line by bonds to be voted by the municipality, and for the operation of the same by the Pacific Electric Railway.

Pekin (Ill.) Municipal Railway.—The Pekin Association of Commerce has petitioned the City Council to order extensions to the lines of the Pekin Muncipal Railway.

Boston (Mass.) Elevated Railway.—This company is preparing to carry out an extensive improvement program involving a new power installation in its main power house and the reconstruction of its carhouse and yard layout. The proposed track work calls for a thorough rehabilitation and reconstruction. The plan will require about four years for its completion.

Eastern Massachusetts Street Railway, Boston, Mass.—The city of Revere, Mass., has petitioned the Legislature to give the State Department of Public Utilities authority to consider a plan whereby the Eastern Massachusetts Street Railway would secure a lease of the East Boston Tunnel and the track rights of the Boston Elevated Railway in East Boston, and would build two miles of track, in order to shorten the present route between Boston and Revere. Under the plan the company would build a freight station at the western terminus of the East Boston Tunnel.

Public Service Railway, Newark, N. J.—The City Council of Camden, N. J., has requested the Public Service Railway to double track its line in State Street, Camden, for a distance of five blocks.

Cincinnati (Ohio) Traction Company.—The Cincinnati Traction Company plans to reroute several of its lines and to extend its Warsaw Avenue line. The cost of the improvements will approximate $1,500,000.

Toronto (Ont.) Civic Railway.—The Board of Control has approved the estimates of Works Commissioner Harris for $168,378 for the construction by the Toronto Civic Railway of a line on the Prince Edward Avenue viaduct.

Montreal (Que.) Tramways.—The Montreal Tramways will shortly begin work on an extension to its Park Avenue line.

Dallas (Tex.) Railway.—The Dallas Railway will shortly begin work on its Masten Street extension.

Virginia Railway & Power Company, Richmond, Va.—The Virginia Railway & Power Company has been authorized by its board of directors to spend $123,329 in track renewals and exten-

sions. The appropriation will cover the reconstruction of 8,395 ft. of track on Hull Street, four blocks on Main Turnpike, and 700 ft. on Eighth Street, Street, 1,900 ft. on the Petersburg and the extension of the double track at the end of the First Street line for 2,902 ft. Work will begin as soon as materials and competent labor can be procured.

Seattle (Wash.) Municipal Street Railway.—Work has been begun on the East Marginal Way extension of the Seattle Municipal Street Railway. The construction involves the installation of a 3-ft. fill, 1,400 ft. long. The project will cost $170,000.

Trade Notes

Safety Car Devices Company, St. Louis, Mo., has established a district office in the Munsey Building, Washington, D. C.

American Armature Engineering Company, Bluefield, W. Va., has let contracts for a plant, 40 x 100 ft., at Mullins, W. Va.

The Black & Decker Manufacturing Company, Baltimore, Md., has established a permanent office and showroom at 1436 South Michigan Avenue, Chicago, in charge of R. G. Ames, whose territory has been extended to cover the entire Mid-West. F. E. Marrion and J. N. LaBelle will assist Mr. Ames.

Poole Engineering & Machine Company, Baltimore, Md., on Feb. 1 moved its general office from 50 Church St., New York City, to its works at Baltimore. The company will still maintain a district office at 50 Church Street. All general correspondence should be addressed to Baltimore, Md.

The Continuous Rail Joint Company of America has received orders for approximately 2,500,000 continuous and Weber rail joints so far this year. The bulk of this is, of course, in the steam road field. Deliveries are now being made only in time to meet rail deliveries.

Buda Company, Harvey, Ill., announces that Frank W. Marvel, formerly Middle West representative and later in the eastern territory, has again been transferred to Chicago as the Middle-West representative of the company in the electric railway field. Peyton W. Wood, who has been handling the territory in the Middle West will represent the company in Southern territory with headquarters at New Orleans.

Oxweld Acetylene Company, Newark, N. J., and Chicago, Ill., has recently extended its manufacture of oxy-acetylene apparatus and equipment to include "Eveready" welding and cutting outfits. This is a new name but the apparatus is not new, excepting for certain refinements of design, having been used extensively in the metal-working trades for several years under the name of "Prest-O-Lite" apparatus.

Standard Underground Cable Company, New York, N. Y., announces that its Detroit sales office, which for several years has been a sub-office of the Chicago office, has been made a full branch office with R. E. Green in charge. Mr. Green has been in charge of the Detroit office since it was first opened. He has been connected with the Standard Underground Cable Company since 1909 as salesman and is well known in his territory.

Western Electric Company, New York, N. Y., has appointed A. Buehler, sales manager at its Minneapolis office. Mr. Buehler joined the company in the early part of 1915, and became sales manager at Omaha during the fall of 1917. Eliot Lum has been promoted to be sales manager at the Omaha office, to succeed Mr. Buehler. Mr. Lum joined the company in 1905, and in 1907, became a member of the telephone engineering department at Chicago. In 1909 he was transferred to the sales department of the Minneapolis house, joining the Omaha organization in a similar capacity in the winter of 1912.

American Steam Conveyor Corporation, Chicago, Ill., has appointed the Kon-Wald Engineering Company, Mutual Life Building, Buffalo, New York, of which F. A. Konzelman is manager, as its representative in Buffalo and Western New York. The Brooks-Fisher Company, Candler Building, Atlanta, Georgia, are now southeastern representatives. J. M. Fisher of this company was for fifteen years in the erection department of the Babcock & Wilcox Company, the last six of which he was district superintendent of the Atlanta territory. E. A. Brooks, was assistant sales manager of the Atlanta office of the Babcock & Wilcox Company.

Ohio Brass Company, Mansfield, Ohio, is introducing its gas-welded type of rail bond into the signal field. It has been the practice in connection with steam-road track signal installations to utilize a long solid wire bond fastened to the web of the rail and with the terminals spanning the splice bars. By contrast, the Ohio Brass bond terminals are fastened to the rail head and only about 3 in. apart. It developed that this short span is a particular advantage, since some 60 per cent or more of the breakages in rails occur through the bolt holes underneath the splice bars. With the long type of bond now used for the signals a rail break of this character does not open the signal circuit, and the signals do not therefore protect against this kind of break. The new Ohio Brass bond, however, would cause the signal to assume the danger position if a break in the rail occurred anywhere. This bond was exhibited at the National Railway Appliance exhibit in Chicago, March 13 to 18, and attracted a great deal of interest among railway signal engineers.

New Advertising Literature

Pelton Water Wheel Company, San Francisco, Cal.: Bulletin No. 10 describing its lines of centrifugal pumps.

W. S. Godwin Company, Baltimore, Md.: Booklet B descriptive of steel paving guard for use with groove girder rail and street railway paving.

Russell Manufacturing Company, Niagara Falls, N. Y. A catalog on the "Triggerlock Reversible Controller Finger," showing economies possible by use of this product.

American Steam Conveyor Corporation, Chicago, Ill. Folder containing fifty to sixty trade marks and trade names of nationally advertised concerns using American steam jet ash conveyors.

Locomotive Superheater Company, New York, N. Y.—Bulletin T-5 on the "Advantages of Superheated Steam," setting forth in concise language statements of interest to all power plant owners.

Mitchell-Rand Manufacturing Company, New York, N. Y., has sent out cards of samples of armature twines. The company has adopted a new system of gaging these twines, which greatly simplifies the method of determining sizes.

General Electric Company, Schenectady, N. Y.: Bulletin No. 47,419-A, superseding bulletin No. 47,419, descriptive of its small-capacity industrial oil circuit breakers, type FP-10, 50-amp., 600-volt, for three-phase and quarter-phase induction motors of 25 hp. or less.

Esterline Company, Indianapolis, Ind., Bulletin No. 395 covering power factor recording instruments which points out the evils of low power factor to the central station, to the isolated plant and to the power customer, as well as how to locate and eliminate the causes of low power factor.

The English Electric Company, Ltd., Queens House, Kingsway, London, England: The first number of the English *Electric Journal* dated January, 1920, being Vol. 1, No. 1, of this publication. This company represents under a new name a consolidation of the number of old companies which it controls and operates under one management. It includes the Dick, Kerr Works, Preston; the Ordnance Works, Coventry and Scotstoun; the Phoenix Works, Bradford; the Siemens Works, Stamford; and the Williams Works, Rugby, which with the exception of the Ordnance Works, are all well known as pioneers of the electrical industry in its various branches in England. Many illustrations and descriptions of large turbines, railway motors, control equipment, rolling stock showing multiple unit control equipment as used on the Continent, trucks and third rail equipment, track and roadway construction as well as a number of technical articles are included.

Have Your Emergency Brakes Enough Power to Stop Your Heavies?



Try them yourself. Do not wait until some unfortunate accident brings them forcibly to your attention.

The large cars in Elmira needed good brakes. They wanted brakes which the motorman not only WOULD but COULD use. These cars are now equipped with

Peacock Staffless Brakes



"The Peacock Staffless"

Incidentally, there is no more broken door glass caused by the brake wheel interfering with the door operation.

The Peacock Staffless stands close to the dash, out of the way, and occupies only one half the platform space used by the old brakes.

If your cars need more Power and more Room —they need Peacock Staffless Brakes

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Engineers.
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J. G. WHITE ENGINEERING CORPORATION
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Industrial Plants and Buildings. Steam Power Stations. Water Power Developments. Substations. Gas Plants. Transmission Lines. Electric and Steam Railroad Work.
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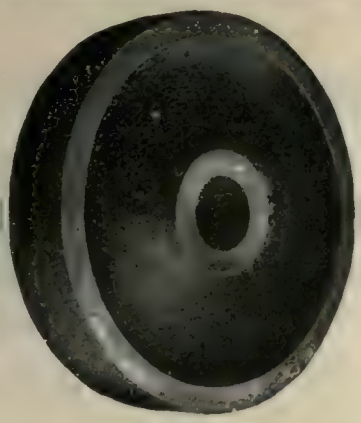
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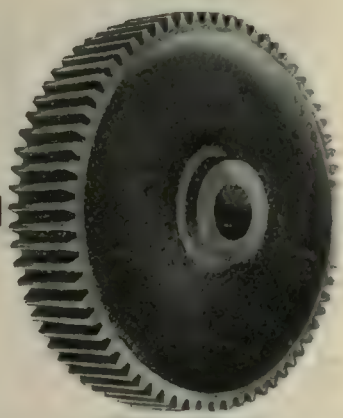
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The Most Successful Men in the Electric Railway Industry read the
ELECTRIC RAILWAY JOURNAL
Every Week



Steel Blank



Finished Gear

Carnegie Steel Gear Blanks

Real gear economy consists in purchasing only those gears which have a good performance record and are made by a responsible organization.

Gears cut from Carnegie Steel Gear Blanks are gears of high quality and known reliability. Under the most severe industrial conditions their performance record proves that they will outwear cast steel gears three to seven times, and, when properly heat treated, will never break.

When buying gears from your gear cutter, insist on Carnegie Blanks. Once they are installed you can forget all about your gear problems.

The engineers of this company will gladly confer with you as to better service in gear transmission.

Carnegie Steel Company

General Offices: Carnegie Building, Pittsburgh, Pa.

1321

WE BUILD TRACKS

Design—Construction—Rehabilitation

ENGEL & HEVENOR

Track Engineers—Contractors

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ELECTRICAL TESTING LABORATORIES
Electrical, Photometrical and Mechanical Testing.
80th Street and East End Ave., New York, N. Y.

Scofield Engineering Co. Consulting Engineers PHILADELPHIA, PA.
POWER STATIONS — GAS WORKS
HYDRAULIC DEVELOPMENTS — ELECTRIC RAILWAYS

THE P. EDW. WISH SERVICE
Suite 1710 Park Row Bldg., New York — DETECTIVES — *Suite* 1102 Board of Trade Bldg., Boston

When writing the advertiser for information or prices, a mention of the Electric Railway Journal would be appreciated.

KELLY, COOKE & COMPANY

Engineers

149 BROADWAY NEW YORK
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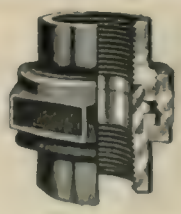
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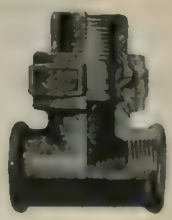
Monadnock Building, Chicago



Canton Portable Crane—Capacity up to 7,000 lbs. Easy to lift and haul.



Dart Female Union—Note the ground bronze seats.



Dart Tee Union Elbow on the Outlet—no place for sediment.



Dart Tee Union on the Run—the flow is not hindered at the joint.



Dart Union Elbow male to female.

In Shop and Power Plan

Your shop foreman—the chief in your power plant—each relie on products bearing the "Fairbanks O. K." They know tha anything from a Fairbanks Branch House can be trusted fo long and satisfactory service. Here are three lines which ar particularly useful in power houses, machine shops and freigh houses:

CANTON PORTABLE CRANES AND HOISTS

Don't take six men's time to lift a heavy burden when one man can do it with a Canton Portable Crane.

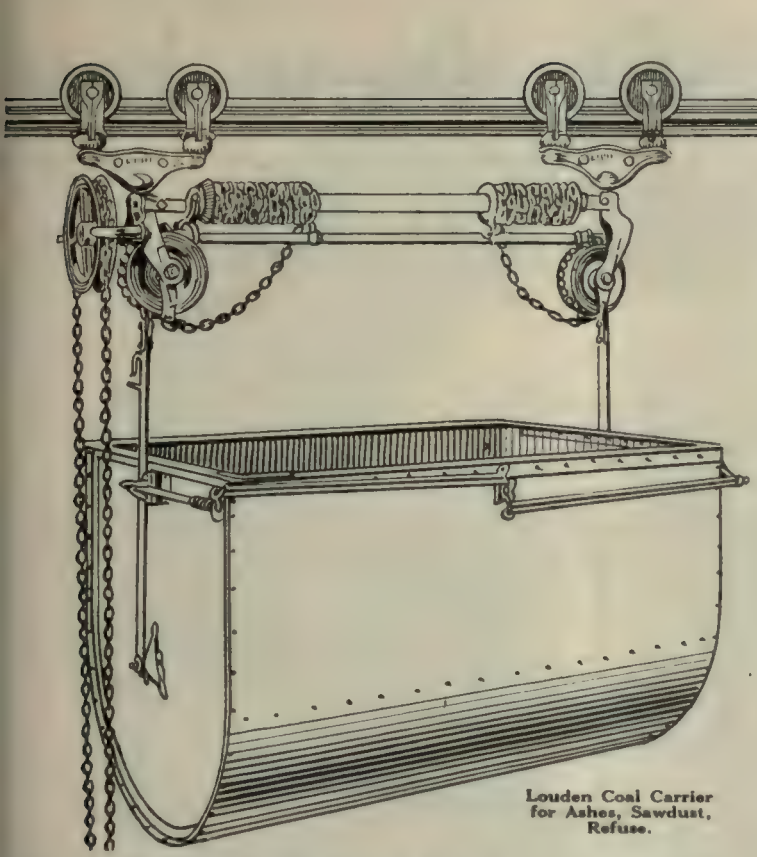
In freight-handling, in setting up machinery, in removing heavy parts for repairs, a Canton Crane will soon save its cost. Many specia uses will be found for it—such a pulling cables into conduits by means of its winding-drum. Roller bearing wheels make it easy to mov about. The safety of your men i assured by the "Fairbanks O. K." given only after rigorous tests.

LOUDEN OVERHEAD CARRIERS

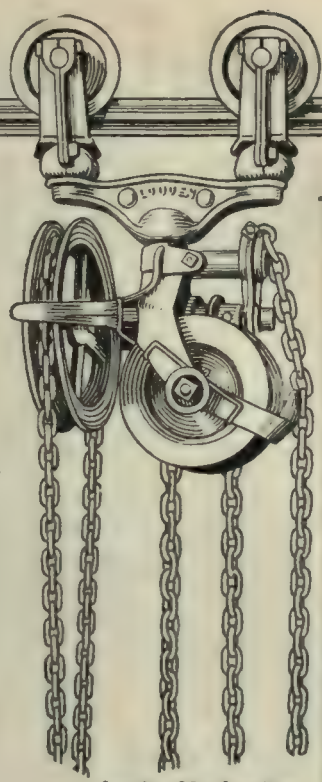
Louden Carriers transport materials of all kinds. The coal carrier shown above is very useful in the boiler room to handle coal and ashes; the merchandise carrier finds a hundred uses in the storeroom the freight terminal and the ware house. Put your interior transpor tation problem up to the neares Fairbanks Branch House.

FAIRBANKS O.K.

MILL, MINE AND RAILWAY SUPPLIES - SCALES - VALVES - POWER TRANSMISSION - MACHINE TOOLS



Louden Coal Carrier for Ashes, Sawdust, Refuse.



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Mill, Mine and Railway Supplies



Trucks and Wheelbarrows



Machine Tools



Scales



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Automobile and Service Station Equipment

let FAIRBANKS serve you

DART UNIONS

There are no drip marks on the floor under a Dart Union. Ground bronze seats, swedged in, make a tight joint without forcing. Every time you "remake" it, the joint will be tight. You won't have to depend on corrosion to close up little leaks.

Ask the nearest Fairbanks Branch House for a free sample.

Buyers know that the "Fairbanks O. K." stands for dependable merchandise at fair prices. When you need any sort of mechanical equipment, call on the nearest Fairbanks Branch House to furnish it.

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TRUCKS AND WHEELBARROWS - ENGINES AND PUMPS - AUTOMATIC AND SERVICE STATION EQUIPMENT

The Old Made New by INDIANAPOLIS



There is no need scrapping old track. It can be made as good as new by eliminating all bonds and bolts. The "Apex" Joint when welded to your track does away with all these and in reality makes your track a joint-less track with greatly increased life.

Indianapolis products are made to save you money. In doing this they give you better track at less cost. Our terms are made to suit your pocket book.

Send for details

Indianapolis Switch & Frog Co.

Springfield, Ohio



-decrease overhead maintenance costs with

ANACONDA COPPER WIRE

Copper wire used in electric railway construction must be of exceptional purity to withstand the stresses and strains of constant service.

The material from which Anaconda Copper Wire is made insures *maximum* purity. It is drawn from the famous B & M Brand Copper Bars, which contain less than 1/100 of 1% metallic impurities.

When new work or additional construction is contemplated allow our engineers to figure on your requirements.

ANACONDA COPPER MINING COMPANY
Rolling Mills Dept. Great Falls. Mont.
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The "B" assortment $50.00

Tell your foreign-born employees about

"Food Drafts"

HERBERT HOOVER, in a letter published in our editorial pages, urges engineers to explain the Food Draft System to their foreign-born employees and to interest them in its possibilities and value.

The American Relief Administration has on the press a quarter-sheet poster telling all about this, in all the essential foreign languages.

The 11 McGraw-Hill Publications strongly urge the cooperation of their readers in this most economical and practical method of supplying needed food to sufferers in Europe, and recommend sending for as many of these posters as you can use. Address American Relief Administration, 115 Broadway, New York. *They will be sent free of all charge.*

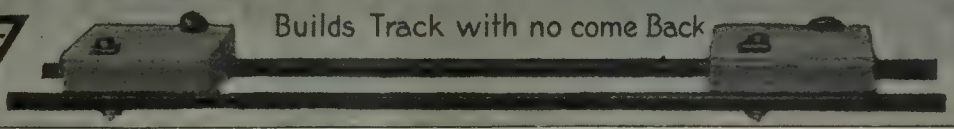
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Builds Track with no come Back



Why does pavement last longer when the principle of

Resiliency

is applied to the car tracks?

The Asphalt cushion of the Resilient Railway Tie gives an unvarying deflection to the rail under the weight of the cars. Not too much as in the case of wood ties working in ballast nor too little as in monolithic construction. The joint ties prevent all working at the joints.

These things accomplished by Resilient Ties make toward pavement permanence.

THE DAYTON MECHANICAL TIE CO., 704 COMMERCIAL BLDG., DAYTON, OHIO



The Car Card is judged by it's results.

Good car cards keep advertisers satisfied because they produce increased sales.

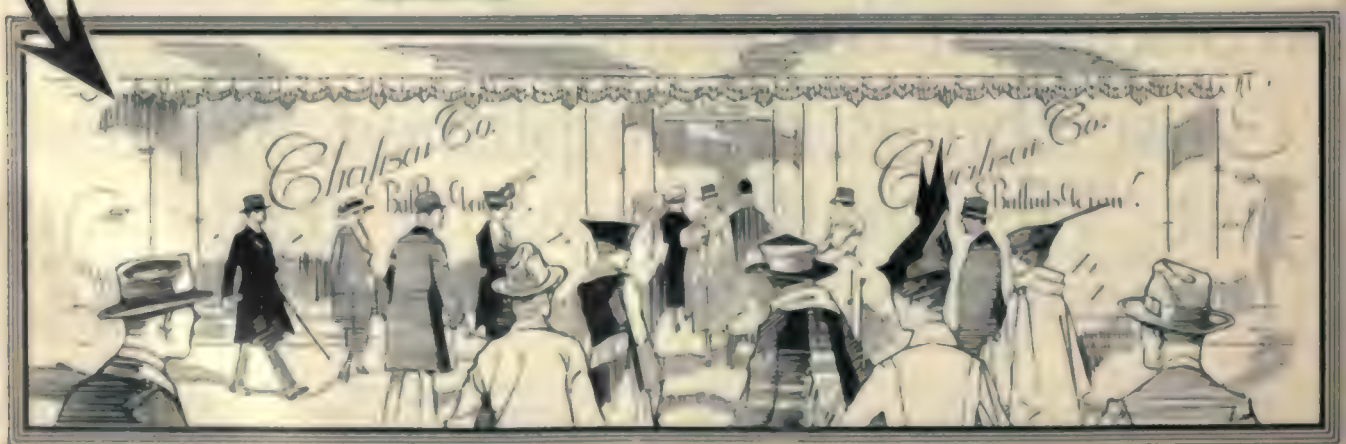
Collier Service

is the concentration of the best advertising ideas and plans applied to car cards.

To the electric railway this means a regular monthly check which assures a permanent and steady income. Collier Service is nation wide in scope. It reaches all and serves all

Barron G. Collier
INCORPORATED

Chandler Bldg., New York





THERMIT-WELDED Special Work Gives You More Money for New Cars

It's mighty little special work that you can buy today for $60,000!

Yet if you had the same sum to spare for Safety Cars, you could buy say ten cars.

With these cars operating 500,000 miles in one year at 30 cents per mile, your gross earnings would be $150,000 and your *net* at least 5 cents per mile, or $25,000.

It stands to reason then that if you can cut down on your special work expenses you will be glad to do so for the sake of buying something that has proved such a sure money-maker.

That is why we are glad to advise you that Thermit-Welded special work, which can be made by your own forces, is now at your service to give you the same satisfaction and economy in special work that the Thermit Insert Weld is giving in producing a truly continuous rail.

THERMIT-WELDED Special Work Has Proved Capable of Carrying Heavy Cars

And yet its cost is absurdly low in comparison to short-lived, built-up work or special insert intersections. With its aid, also, you eliminate the bolt, the plate, the joint and the other accessories that have always been necessary with mechanical fastenings that cannot and do not stay put.

Just advise us what rail sections you use and how many crossings of each you wish to make, and we will quote you prices at once. The permanent Thermit equipment can also be used for welding compromise joints, broken motor cases, truck frames, armature shafts or any other heavy steel sections.

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SURPACO

Sur-Lin-O

Instead of Linseed Oil

Sur-Lin-O satisfactorily replaces linseed oil as a thinner for paints of any character, Oxide, Carbon, Lead or Zinc, *at a saving of 40%.*

Made on a pure linseed oil base, *Sur-Lin-O* has the same gravity, ease of working and freedom of flow as linseed oil, but its drying and hardening qualities make it unnecessary to add a drier to the paint.

Sur-Lin-O dries with a better gloss than linseed oil, is equally as elastic, is a non-absorbent of moisture and is not detrimental to the wearing properties of paint.

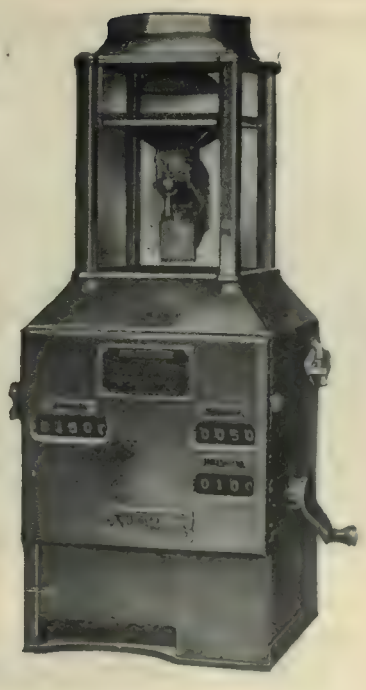
Wherever necessary, our Service Engineers will work with you closely for the proper and economical solution of any painting problem.

Sur-Lin-O is sold to large consumers direct from factory in barrels, halves and fives. Working samples and particulars furnished on request.



St. Louis Surfacer & Paint Co.
Hazel and Union Avenues
St. Louis, U. S. A.
Paints for Large Corporation Users Only

The *Combination*
Johnson Fare Boxes
Johnson Metal Tickets



Will help your Conductors get all the Fares

Every time your conductors have to make change, there arises the possibility that some of the passengers will drop less than the correct fare in the farebox and that others will step into the body of the car without tendering any fare at all.

That is unjust to you and unjust to your conductors.

But you can stop such losses with the combination of the Johnson Metal Ticket and the Johnson Fare Box.

The Johnson Metal Ticket backed by a strong selling campaign can be made practically to eliminate the annoyance and losses of change-making, no matter what your rate of fare is or how often that rate of fare is altered.

The Johnson Fare Box insures the absolutely accurate and unfailing registration, not only of each and every metal ticket, but of each and every fare paid in cash.

Our experience in assuring the successful teamwork of Johnson Fare Boxes and Johnson Metal Tickets on a great many electric railways of every size is yours to command.

Johnson Fare Box Company

Jackson Blvd. & Robey St., Chicago
50 E. 42nd St., New York



This Blockade Cost Hundreds of Dollars All Due To a Hot Box

IT is not the Hot Box itself that costs so much, but the results which are caused by the hot box.

For instance. Twenty-five cars become blockaded for half an hour. This means all traffic is tied up on that particular line, and therefore all revenue stops. This all makes the hot box very expensive.

The question then arises, how can you eliminate hot boxes? Franklin Perfection Journal Box Packing will eliminate a very large percentage.

So well does it distribute the oil to the journal that while there is oil in the journal box just so long will there be lubrication delivered to the journal itself, and this means no hot boxes.

Franklin Perfection is a product developed after years of careful study and experience along journal box packing lines. To use it means to minimize hot boxes and thereby stops these results.

It will pay you to investigate and send for samples, because once a customer always a customer

The Franklin Manufacturing Company

Franklin, Pa.

See This Useful Series For 10 Days FREE

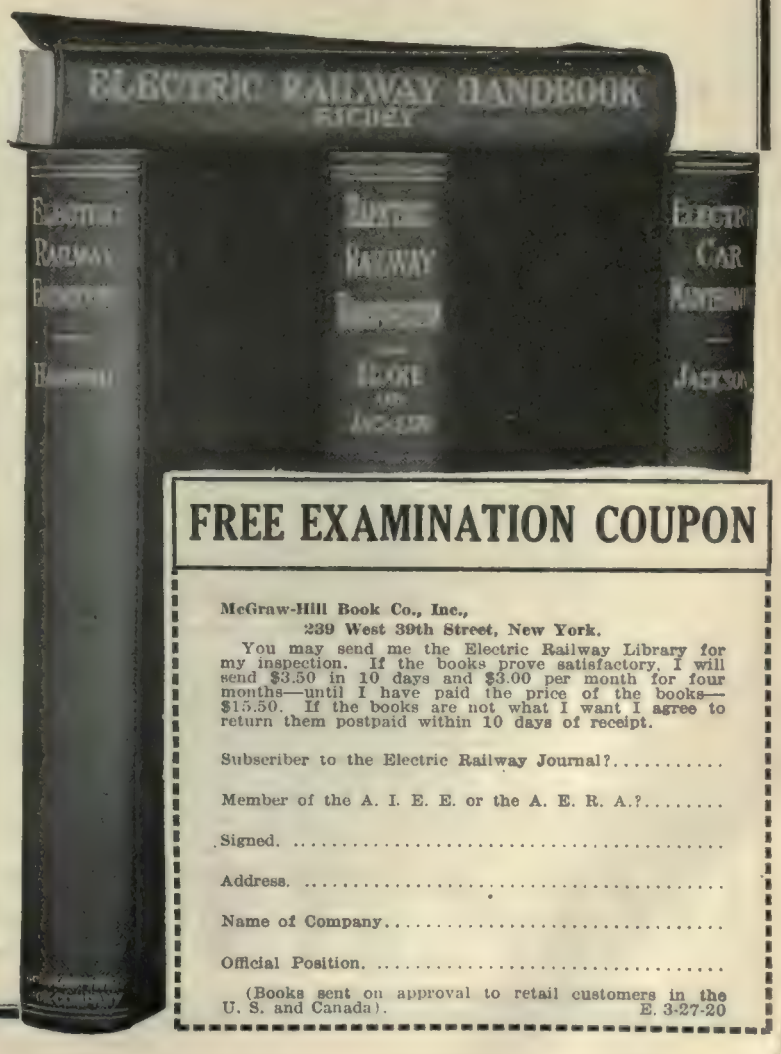
You are reading this advertisement because you can use up-to-date electric railway data. We do not know if you are concerned with construction, operation or maintenance problems. We do know that the Electric Railway Library is unrivalled as a source of clear-cut facts on the subject. To convince you of the usefulness of this set of books we will send them for 10 days' FREE examination. If you decide to keep them, and we are sure you will, payment may be made on liberal subscription terms.

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4 volumes, over 2,000 pages, fully illustrated
$15.50 postpaid, payable in five installments

The four books give modern, reliable information derived from the actual experience of practical electric railway engineering men. The library contains no far-fetched suggestions—practical usefulness is its keynote. It points out ways and means of increasing efficiency and lowering costs which other engineers have found successful. You can apply these methods to your every-day problems. Why not make this information count for you? It will shorten the road to better results.

ELECTRIC RAILWAY ENGINEERING is a thorough manual of the broader engineering problems. ELECTRICAL RAILWAY TRANSPORTATION covers the business side of the subject—the relation of traffic to profits. ELECTRIC CAR MAINTENANCE has saved money for hundreds of lines. It is a complete treatment of this special subject. The ELECTRIC RAILWAY HANDBOOK is a pocket encyclopedia of electric railway construction, operation and maintenance. It is the Webster of the industry.



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The Safest Safety Cars Are Boyerized Cars



Do we believe in Safety Cars? We do!

Can we make Safety Cars safer still? We can!

How?

By equipping their brake-rigging with Boyerized Pins and Bushings.

Why?

Because the higher rate of braking used on Safety Cars and the fact that the public has an eagle eye on these cars make it good business and sound sense to assure SAFETY FIRST.

Don't wait for the first pins and bushings to wear out—play safe from the start by specifying Boyerized only.

The same safety and long life that you and hundreds of other electric railways are receiving from Boyerized Pins and Bushings on the present large cars should be and can be yours if you will specify their installation from the very beginning of operation.

There is but one grade of pins and bushings that can be relied upon absolutely to give years of service. That's why

To **Boyerize** means to lengthen the life of your equipment and to lower the cost of your upkeep.

Other Boyerized Specialties are:

Boyerized Brake Hangers.

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Boyerized Wearing Plates between the Bolster and Bolster Carrier.

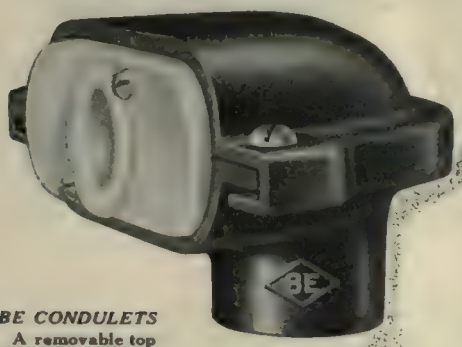
Boyerized Wearing Plates between the Pedestal Straps and the Journal Box.

ELECTRIC RAILWAY SUPPLIES

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SPRINGFIELD MASS

CONDULETS



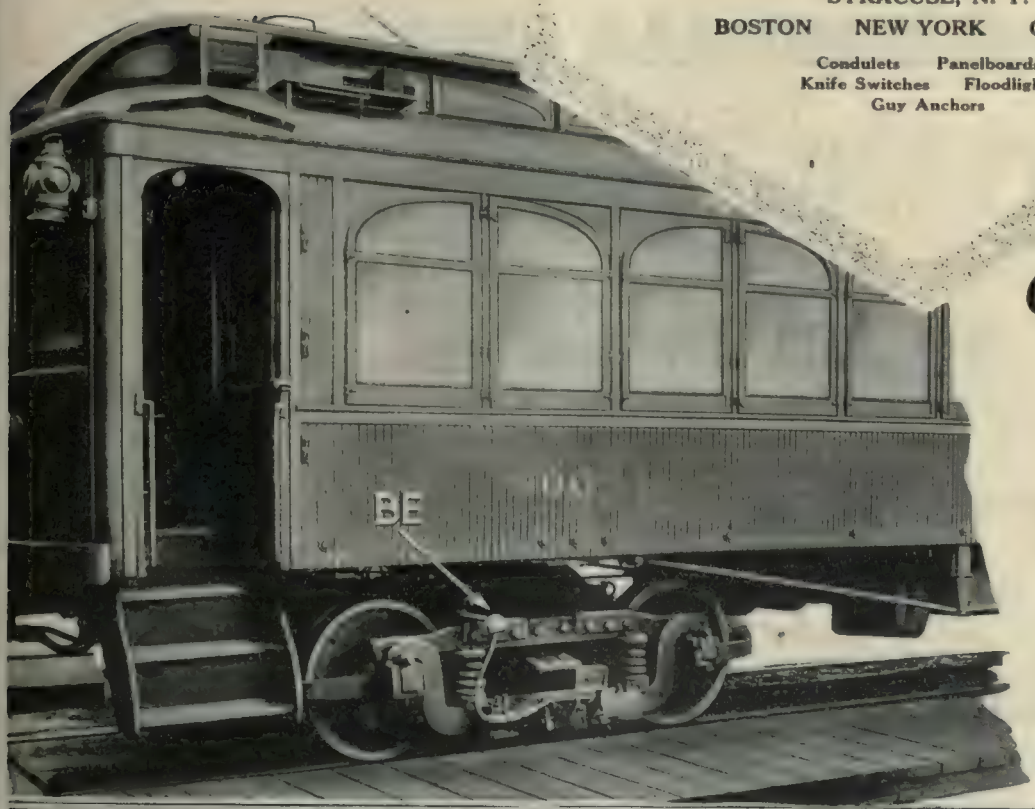
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A removable top makes it possible to get a straight pull on the Conductor. This is of special value when pulling large Conductors.

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BY conduletting your rolling stock and buildings you can reduce your operating and maintenance costs.
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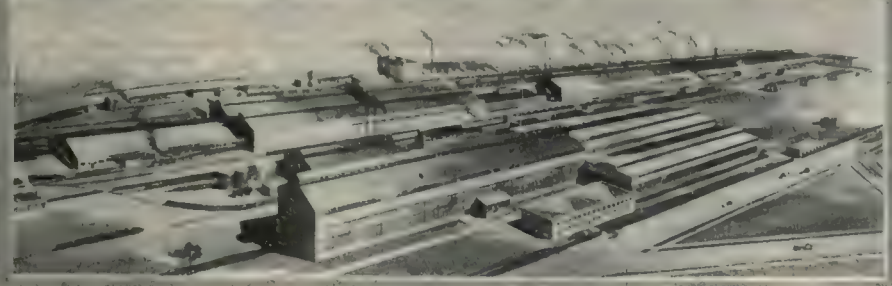
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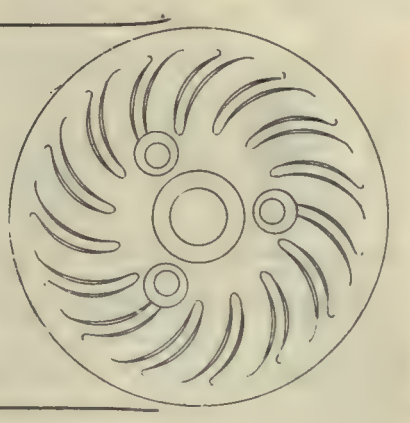
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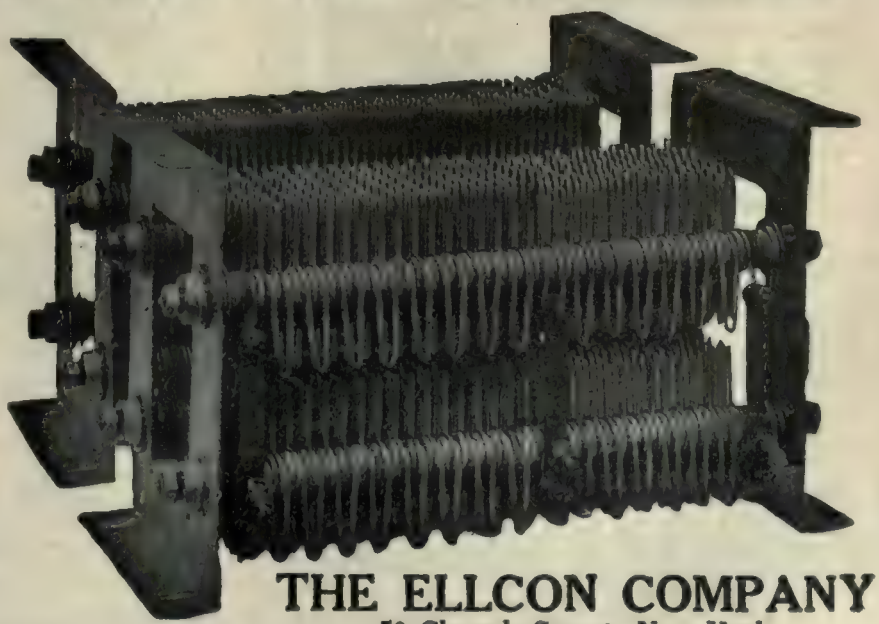
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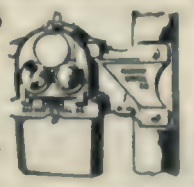
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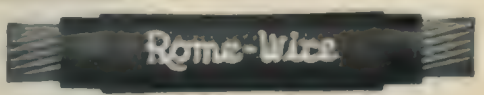
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Means Uninterrupted Operation

The NEVER-CREEP anchor represents a mighty advance in the reinforcement of poles.

It pulls only against solid, undisturbed ground —that's why it cannot climb nor creep, nor lessen its strength or holding power from the moment of its installation until it is removed intentionally.

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For Storing and Reclaiming, Loading and Unloading Cars, Trucks and Wagons. Does the work of from 6 to 12 men and keeps equipment moving. Write for Literature.

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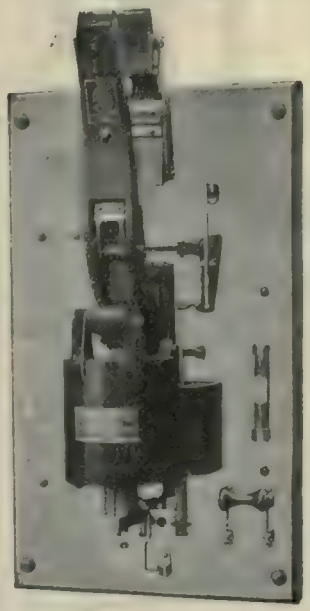
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Write for complete description. Write for "Safety Always" telling the real story of fire extinguishing liquids.

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They not only eliminate the necessity of an attendant, but at the same time give better protection and reduce maintenance expense.

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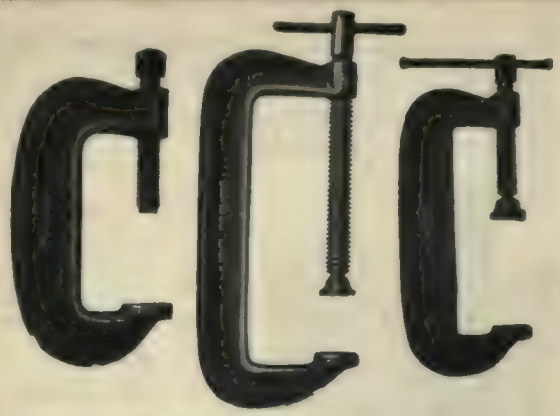
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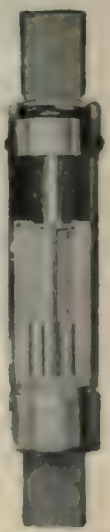
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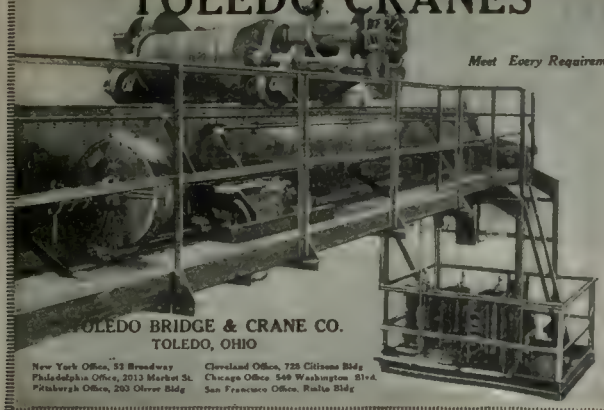
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for heavy street railway work are the best obtainable. Write for New Complete Catalogue.

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Full power with
High or Lower Adjustment

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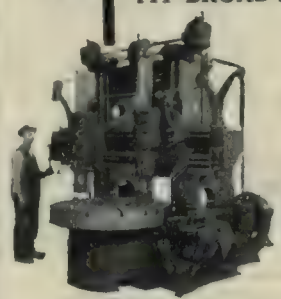
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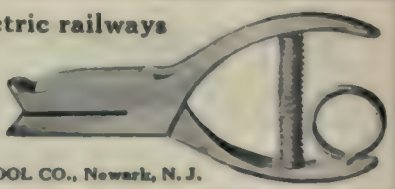
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VENTILATORS Also Ventilate in Stormy Weather.
THERMOSTATS Save Current.
ORIGINATED the use of NON-CORROSIVE Wire for Electric Car Heaters.
ORIGINATED The Ventilated Coil Support.

LET US FIGURE ON YOUR NEXT REQUIREMETNS
Gold Car Heating & Lighting Co., 17 Battery Pl., New York



THE
CLEVELAND
Is the practical Fare Box for
One Man Car
Let us tell you why
The Cleveland Fare Box Co.
Cleveland, Ohio
Canadian Branch: Preston, Ont.

75% of the electric railways use
B-V Punches
Send for Catalog.
BONNEY-VEHSLAGE TOOL CO., Newark, N. J.



Electric car heaters—thermostatic control—pneumatic car door operators—buzzers, single-stroke bells, starting signal lights—special resistances.
CONSOLIDATED CAR HEATING CO.
ALBANY, NEW YORK, CHICAGO

PS HEATERS
Car Heating and Ventilation
is one of the winter problems that you must settle without delay. We can show you how to take care of both with one equipment. Now is the time to get your cars ready for next winter. Write for details.
The Peter Smith Heater Company
1725 Mt. Elliott Ave., Detroit, Mich.

Heating and Ventilating
Let us demonstrate to you how we can heat and ventilate your cars at the lowest possible cost
The Cooper Heater Company
Carlisle, Pa.



Steam and Electric Railway "Checking"
Complicated Interurban and Ohmer Fare Register work a specialty. Confidential Investigations. Write for our proposition, "Prosecuting Dishonest Conductors." We maintain a special department thoroughly equipped for handling all strikes.
The Industrial Protective Company
Suite 804-5-6 Mutual Home Bldg., Dayton, Ohio

The Kalamazoo Trolley Wheels

have always been made of entirely new metal, which accounts for their long life WITHOUT INJURY TO THE WIRE. Do not be misled by statements of large mileage, because a wheel that will run too long will damage the wire. If our catalogue does not show the style you need, write us—the LARGEST EXCLUSIVE TROLLEY WHEEL MAKERS IN THE WORLD.



THE STAR BRASS WORKS
KALAMAZOO, MICH., U. S. A.

USG
CARBON—GRAPHITE—METAL BRUSHES
For Car and Power House Units

Motion Graphite Curve Grease
Motion Graphited Wool Grease
For Gears of Electric Cars
Motion Graphite Journal and Gear Grease
Literature and Special Information on upon request.

The United States Graphite Co.
SAGINAW, MICH., U. S. A.

Largest Makers of Graphite on This Continent



Hale & Kilburn
No. 108-AV Stationary Seat
For One-Man Safety Cars.

The unmatchable H&K Seat beats the world for strength and lightness. Every Safety Car should be equipped with it.

HALE & KILBURN CORPN.

	Philadelphia	
New York	Chicago	St. Louis
Detroit	Washington	Atlanta
Louisville	San Francisco	Dallas

Bound Brook Trolley Wheel Bushings Give Longer and Better Service

THERE are more Bound Brook (Oil-less) Trolley Wheel Bushings in use today than all other makes combined. That is because Bound Brook Bushings, by virtue of their construction, invariably outlast all other types.

All Genuine Graphited Oil-less Bushings have always been made at Bound Brook, U. S. A.

BOUND BROOK OIL-LESS BEARING COMPANY
Bound Brook, New Jersey *Detroit Office: 1723 Ford Bldg.*

TRADE MARK
IRVING SAFSTEP
(PATENTED) REG U S PAT. OFF.
ABSOLUTELY NON-SLIPPING ALWAYS
Write for Catalog 2A28
IRVING IRON WORKS CO.
LONG ISLAND CITY, N. Y., U. S. A.



The Economy Railway Meter
Induces Power Saving.
Our power-saving bulletins will vitally interest you right now. Ask for them.



Economy Electric Devices Co., Chicago



Russell Mfg. Co.
Makers of
Triggerlock Reversible Controller Fingers
with reversible and renewable tips
U. S. Factory: 814-18 Bath Avenue, Niagara Falls, N. Y.
Canadian Factory: 557 King Street, West, Toronto, Canada



Use them in your terminals—
PEREY TURNSTILES or PASSIMETERS
Faster than the ticket seller
Perey Manufacturing Co., Inc.
30 Church Street, New York City



Direct Automatic Registration
By the
Passenger
Rooke Automatic Register Co.
Providence, R. I.

Keep your Eye on the SEARCHLIGHT SECTION and your advertisements in it.



612

DREW MOTORMEN'S SAFETY MIRRORS
Eliminate Accidents
Send for catalogue No. 18
DREW ELECTRIC & MFG. CO.
1016 E. Michigan St., Indianapolis, Ind.



Trolley Bases
for
City and Interurban Service

THE strength necessary to sustain continuous wheel pressures is contained in the tempered steel springs in addition to the hardened and balanced parts of the 15-C Nuttall trolley base.

R. D. NUTTALL CO.
Pittsburgh, Pa.

MEMBER OF AGMA

Nuttall Helical Gears
A PROVEN SUCCESS



McGuire-Cummings Mfg. Company

General Offices—111 West Monroe St., CHICAGO

City and Interurban Cars and Trucks, Snow Sweepers and Plows,

Express, Combination and Work Cars, Electric Locomotives

The "Hycap-Exide" Battery
for
STORAGE BATTERY STREET CARS

THE ELECTRIC STORAGE BATTERY CO
PHILADELPHIA

If there is anything you want—

or something you don't want that *other* readers of this paper can supply—or use—advertise in the

Searchlight Section

NOW— is the time to offer good second-hand equipment or machinery for sale. The demand is great for good plant for immediate delivery. That's why you should advertise NOW.

NOW— or any other time, use the Searchlight Section for advertising

Agencies Wanted	Contracts Wanted	Miscellaneous Wants	Positions Wanted
Agents Wanted	Educational Courses	New Industries Wanted	Property For Sale
Auction Notices	Employment Agencies	Partners Wanted	Receivers' Sales
Buildings For Sale	Exchanges	Patents For Sale	Representatives Wanted
Business Opportunities	For Rent Items	Patent Attorneys	Salesmen Wanted
Civil Service Opportunities	Franchises	Plants For Sale	Work Wanted
Contracts To Be Let	Industrial Sites	Positions Vacant	Etc., Etc., Etc. — 35

PROVIDENCE FENDERS — H-B LIFE GUARDS

The Consolidated Car Fender Co., Providence, R. I.
Manufacturers of The Providence Fender and H-B Life Guard
Wendell & MacDuffie Co., 61 Broadway, New York
General Sales Agents

PIN-AND-LINK — M.C.B. — CAR-AND-AIR
COUPLERS
For All Services
VAN DORN COUPLER COMPANY
2325 South Paulina Street, Chicago, Ill.



STUCKI SIDE BEARINGS

A. STUCKI CO.
Oliver Bldg.
Pittsburgh, Pa.

RAILWAY UTILITY COMPANY

Sole Manufacturers
"HONEYCOMB" AND "ROUND JET" VENTILATORS
for Monitor and Arch Roof Cars, and all classes of buildings:
also ELECTRIC THERMOMETER CONTROL
of Car Temperatures.

141-151 WEST 22D ST. Chicago, Ill. — *Write for Catalogue* — 1328 BROADWAY New York, N. Y.

SEARCHLIGHT SECTION

ADVERTISING RATES

POSITIONS VACANT—Business Opportunities and other undisplayed ads 8 cents a word, minimum $2.00 an insertion.

POSITIONS WANTED—Evening work wanted, tutoring and other undisplayed ads of individuals looking for employment, 4 cents a word, minimum 75 cents, payable in advance.

ADD 5 WORDS for box number in undisplayed ads if replies are to any of our offices. There is no extra charge for forwarding replies.

DISCOUNT OF 10% if one payment is made in advance for 4 consecutive insertions of undisplayed ad.

ADS IN DISPLAY TYPE—Space is sold by the inch (30 in. to a page), the price depending upon total space used within a year, some space to be used each issue.

1 to 3 in., $4.50 an in. 15 to 29 in., $3.90 an in.
4 to 7 in., $4.30 an in. 30 to 49 in., $3.70 an in.
8 to 14 in., $4.10 an in. 50 to 99 in., $3.50 an in.

POSITIONS VACANT — EMPLOYMENT — POSITIONS WANTED

POSITIONS VACANT

ELECTRIC railway master mechanic for a small road operating from eight to twelve cars, near New York City. A steady man, able to do all around work and organize a small force. Give full information, references, and state wages expected. P-611, Elec. Ry. Journal.

ELECTRICAL draftsmen wanted; several, by large construction firm building power stations in Central West. Will pay $1,800 to $2,400 for men with experience in electrical design in connection with power stations, according to ability. Address, giving age, education, experience and salary expected. P-610, Elec. Ry. Journal, Old Colony Bldg., Chicago.

ELECTRICAL repairman wanted. One familiar with overhauling and repairing K type controllers, circuit breakers, rheostats, brush holdes, etc. State experience fully and salary exepected. Apply to Master Mechanic, Saginaw Bay City Railway Company, Saginaw, Mich.

ELECTRICAL draftsman for designing, detailing and layouts in connection with electrical installations in stations and substations. Reply giving age, education, experience and salary desired to Mr. H. A. Seymour, Commonwealth Edison Company, Chicago, Ill.

ELECTRICAL engineer wanted, with some experience in street railway work, in city in Middle West. State experience, references, and salary desired when replying. P-605, Elec Ry. Journal, Old Colony Bldg., Chicago.

WANTED

Experienced Men for Electric Shop and Car House Work

2—Painters
3—Carpenters
2—Wiremen
1—Electric Welder
1—Armature Winder
2—Air Brake Men
1—Truckman
1—General Repairman

Steady permanent positions for good men

Charleston Consolidated Railway & Lighting Co.
Charleston, South Carolina

POSITIONS VACANT

JUNIOR electrical engineers, $1501—$1800. per annum for assignment to inspection of subway, elevated and street railway power houses, equipment and rolling stock. Open to those with three years' acceptable experience in electric railroading and the manufacture and installation of electrical or mechanical apparatus and to graduates in electrical engineering. A number of provisional appointments being made pending examination. Open to citizens only. Age limit 21 to 30 years. Apply to Office of Transit Construction Commissioner, Room 1195, 49 Lafayette Street, New York City.

POSITIONS WANTED

AUDITOR, experienced electric lighting and railway auditor seeks change. High grade executive. 17 years' utility, manufacturing and public accounting. Administration school graduate. Mechanically and electrically trained. Salary $4,000 to start. East preferred, but not essential. PW-604, Elec. Ry. Journal, Real Estate Trust Bldg., Philadelphia.

GENERAL manager, now employed, desires to make change. Twenty years' experience in construction and operation. Good education. Highest references. PW-607, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

HIGH grade master mechanic, thirty-five years of age, having fifteen years' experience on all types of city and interurban equipment, desires to make change about June first. Will furnish highest class references, and reasons for leaving present position. Good executive with proven ability to organize and build up an efficient maintenance force. Address PW-615, Elec Ry. Journal.

MAN, 14 years' experience with large street, railway, light, power and gas properties as accountant, assistant to general manager, secretary, treasurer and auditor solicits change. Age 40; large of statue, physically sound with good personality. A-1 references. Address PW-601, Elec. Ry. Journal.

MASTER mechanic, experienced on city, interurban and M. C. B. equipments, modern shop methods and inspection barn systems, one that can form an efficient organization and get results, married, age 28, has good reasons for wanting to make change, correspondence confidential. PW-603, Elec. Ry. Journal, Old Colony Bldg., Chicago.

MASTER mechanic desires to make change, 16 years' experience in all lines of maintenance and construction, large and small shop methods. Can produce results. PW-612, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

POSITIONS WANTED

MASTER mechanic wishes to make a change; have had 16 years' experience on maintenance and construction in all its branches. At present employed as master mechanic by a road operating from 60 to 70 cars. Can furnish A1 reference from last and present employers, PW-614, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

MASTER mechanic having had twenty years' experience in carbons, substations, steam and gas engines, power house, also construction work, wants position. Can give A1 reference from company at present employed with. Southern Co. preferred. PW-613, Elec. Ry. Journal.

EVENING WORK WANTED

OPERATING statistics, new business possibilities and rate data prepared and analyzed. Accounts prepared and audited. EWW-602, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia, Penn.

AGENTS AND SALESMEN

Manufacturers Attention

Sales representative and engineer, 38 years of age, past 10 years with leading railway supply organization, will establish connection as manufacturer's agent or representative, steam and electric railway supplies on commission basis with salary guarantee; $7,500 minimum. Member of Western Railway Club, Western Society of Engineers, American Institute of Electrical Engineers, Illinois Athletic Club. Twenty years extensive acquaintance, Chicago and Middle West, guarantees capable and efficient representation. Previous executive experience Western district manager. AS-608, Elec. Ry. Journal, Old Colony Bldg., Chicago.

FOR SALE

Rotary Converters

2 150 KW. Gen. Elec., type TC4A, rotary converters, 3-phase, 25 cycle, 373 v. a. c. to 600 v. 250 amp. d. c.; each with 3-60 KW. type H 25 cycle 6600-375 v. oil-cooled indoor type transformers; also both a. c. and d. c. control panels with instruments, speed 750; all in fine condition, immediate shipment. Gregory Electric Co., 16th & Lincoln St., Chicago.

WANTED

Used Wheel Press

200-ton capacity

WARREN ST. RY. CO.
WARREN, PA.

A GREAT OPPORTUNITY FOR A PRACTICAL STREET RAILWAY MAN

FOR SALE

The equity in the rights, property and franchises of

THE GROTON AND STONINGTON STREET RAILWAY COMPANY

represented by all of the shares of the capital stock of that company free from all claims except a bonded debt of $475,000 at 5 per cent.

This property consists of 23 miles of track in the towns of Groton and Stonington in the State of Connecticut, with all necessary property and equipment—it serves many populous and thriving comunities and does a gross business of, approximately, $8,000 per mile. Full particulars upon application.

By order of the court, I am authorized to receive bids for the above street railway property.

ROBERT W. PERKINS, *Receiver*
362 Main Street, Norwich, Connecticut

FOR SALE

FIVE
Open Trailers
FOUR
Motor Cars

For full particulars write

C. J. SWIFT
Highwood Illinois

FOR SALE

4—Center Entrance, All-Steel Cars, Plain Arch Roof, 35 ft. over bumpers, Taylor Double Trucks.

2—G.E. 247-A Box Frame Motors.
2—K-10-P Controllers.

Complete. Splendid Condition. Full details upon request.

ELECTRIC EQUIPMENT COMPANY
Commonwealth Bldg., Philadelphia, Pa.

FOR EVERY BUSINESS WANT—

"Think
SEARCHLIGHT
First"

0108

FOR SALE

BOILERS

2—500 H.P. B. & W. Boilers, in fair condition, water tube.

DALLAS ICE FACTORY,
Cor. Swiss and Hall, Dallas Tex

WORRYLESS ELECTRICAL REPAIRS

On all kinds and sizes A.C. or D.C. motors and generators, starters, welders, controllers, or anything electrical. Quick shipment from stock material of coils commutators—shafts—bearings, etc. Remember our initials stand for our product.

CAREFUL CLEVELAND ACCURATE ARMATURE WORRYLESS WORKS, Inc.

EST. 1895 4732-4-6 ST. CLAIR AVE., CLEVELAND INC. 1918

SOME ONE WANTS TO BUY

the equipment or machinery that you are not using. This may be occupying valuable space, collecting dust, rust and hard knocks in your shops and yards.

SELL IT BEFORE DEPRECIATION SCRAPS IT

THE SEARCHLIGHT SECTION IS HELPING OTHERS—LET IT HELP YOU ALSO.

Machinery in Stock for
Immediate Shipment

ROTARY CONVERTERS

2—300 kw., Westg., 3-phase, 60-cycle, 370-v., A.C., 575-v., D.C., 600 r.p.m.
2—200 kw., G.E., 3-phase, 25-cycle, 85-v., A.C., 125-v., D.C., 8 pole, 375 r.p.m.
1—150 kw., Westg., 2- or 3-phase, 60-cycle, 185-v., A.C., 250-v., D.C., 720 r.p.m.

FREQUENCY CHANGER SET

1—600 kva., Allis-Chalmers Frequency Changer Set, 300 r.p.m., 3-phase, 60-cycle, 2300-v. one end, 3-phase, 6600-v., 25-cycle on other end.

ARCHER & BALDWIN, INC.
114-118 Liberty Street, New York City
Telephone 4337-4338 Rector

Advertisements for the

Searchlight Section



Can be received at the New York Office of Electric Railway Journal until 10 a.m.

Thursday

For Issue out Saturday

0141

RAILS IN STOCK

IMMEDIATE SHIPMENT

GUARANTEED

10,000 Tons New 12-lb. to 100-lb., and fastenings.
40,000 Tons New Open-hearth, first quality, 80 lb.
5,000 Tons Relayers, 25 to 100 lb., and fastenings.
Car and less carload inquiries and orders solicited.
Rails cut to lengths for all purposes.

TRACK ACCESSORIES
BOLTS, NUTS AND SPIKES

We Manufacture

FROGS, SWITCHES, CROSSINGS, PORTABLE TRACK, DUMP CARS, PLATFORM CARS, ETC.

L. B. FOSTER COMPANY

Park Building
Pittsburgh, Pa.

Tribune Building, 154 Nassau St.
New York, N. Y.

Caution—RAIL USERS

If you contemplate needing more track during 1920, BUY NOW. There will be a SCARCITY. We own and offer the following NEW RAILS for prompt shipment:

New 12-lb. Rails, splices, bolts and nuts.
New 30-lb. Rails, angle bars, bolts and nuts.
70-lb. ASCE Relayers.
New 80-lb. Rails, angle bars, bolts, nuts and spikes.
New 90-lb. Rails, angle bars, bolts, nuts and spikes.

They will be gone soon. Write or wire for our quotations.

HYMAN-MICHAELS COMPANY
531 Peoples Gas Bldg., Chicago

BRANCH OFFICES: First National Bank Bldg., Pittsburgh, Pa.; Railway Exchange Bldg., St. Louis, Mo.; East Chicago, Ind.
YARDS AND WAREHOUSES: East Chicago, Ind. and St. Louis, Mo.

RAILS

New			Relay		
2000	tons	100's	350	tons	100's
1800	tons	90's	400	tons	85's
700	tons	85's	300	tons	75's
430	tons	80's	1200	tons	70's
200	tons	75's	800	tons	65's
240	tons	70's	1500	tons	60's
85	tons	65's	4000	tons	56's
500	tons	60's	1100	tons	50's
100	tons	40's	200	tons	45's
20	tons	30's	2000	tons	40's
100	tons	24's	850	tons	35's
330	tons	20's	430	tons	30's
150	tons	16's	230	tons	25's
120	tons	12's	340	tons	20's
17	tons	B's			

10 tons, 7 inch, 70 lb., Shanghai.
110 tons, 9 inch, 90 lb., Grooved Girder.

Good Stock ***Prompt Shipment***

ZELNICKER IN ST. LOUIS

Get our new 100 page bargain bulletin No. 280 for exceptional offering in Cars, Locomotives, new and used Switch Material, Angle Bars, Tie Plates, Rail Braces, Pipe, Piling, Tanks, Engines, Generators, Boilers, Machine Tools, etc.

CARS FOR SALE

2—McKean Gaso-Electric Cars.
1—Differential 20-yd. Cars.
5—Gasoline Passenger Cars.
50—Freight Cars.
12—Electric Sets.
Get our List and Prices.

J. F. DONAHOO CO., Birmingham, Ala.

"Opportunity" Advertising:

Think *"SEARCHLIGHT"* First!

0092



by Informal Bid

Machinery & Engineering Materials

List No. 7

Here are the Conditions of Sale

WHAT IS OFFERED FOR SALE →

The Surplus Property Division, Office of the Quartermaster General of the Army, offers fo sale the Materials, details of which are given on the following pages. Informal Bids will be accepted at any of the offices named below until 3.00 P.M. Eastern Time, APRIL 13th, 1920.

INSPECTION INVITED →

Goods are sold "as is" f.o.b. point of storage. Inspection is invited and may be made at points of storage indicated for each item. Permits to inspect must be obtained from the offices set forth in the specification under each Item.

HOW TO MAKE YOUR BIDS →

Each Item offered is identified by the Item Number given. Bids must specify the Item Number of each Item upon which bids are made. BIDS MUST BE BASED UPON THE BIDDING UNIT SHOWN FOR EACH ITEM. NO SPECIAL FORM OF BID IS NECESSARY. Bids may be made by letter or telegram. No deposit will be required when aggregate of bid or bids of any one bidder is $1,000 or less. When bid or aggregate bids are for more than $1,000, a 10 per cent deposit thereof must be submitted with the proposal. Such bidders as may desire to do a continuous business with the Surplus Property Division, may deposit a term guarantee in the sum of not less than $25,000 with the Surplus Property Division at Washington, D. C., or with the Zone Offices; each term guarantee is to be so worded as to bind the bidder to full compliance with the conditions of any sale with regard to which he may submit proposals during the lifetime of the guarantee. A term guarantee will not relieve the bidder from the forwarding of his certified check for 10 per cent of the amount of any purchase within 10 days from the notification of award.

WHERE TO SEND BIDS →

Address your bids to "Zone Supply Officer" at the nearest of the following offices: Army Supply Base, Boston, Mass.; 461 8th Ave., New York City; 21st St. and Oregon Ave., Philadelphia, Pa.; Coca-Cola Building, Baltimore, Md.; Transportation Bldg., Atlanta, Ga.; Army Bldg., 15th and Dodge Sts., Omaha, Neb.; Ft. Mason, San Francisco, Cal.; 17th and F Streets, N. W. Washington, D. C.; Newport News, Va.; Jeffersonville, Ind.; 1819 West 39th St., Chicago, Ill.; 2nd and Arsenal Sts., St. Louis, Mo., Army Supply Base, Poland and Dauphin Sts., New Orleans, La.; San Antonio, Texas; New Cumberland, Pa.; Columbus, Ohio; or at the Surplus Property Division, Munitions Bldg., Washington, D. C. Further information may be obtained from any of the above offices.

BIDS CLOSE →

Bids will be received at the nearest of the Zone Supply Offices UP TO 3.00 P.M. EASTERN TIME, APRIL 13th, 1920.

The Government reserves the right to reject any or all bids or any part thereof.



SURPLUS PROPERTY DIVISION

Office of the Quartermaster General

Director of Purchase and Storage

MUNITIONS BUILDING

Washington, D. C.

War Department

QUARTERMASTER CORPS

Machinery & Engineering Materials—List No. 7

Item No.	COMMODITY	Quantity	Minimun Selling Unit	Location	For Inspection Apply
	MOTORS				
M-7-058	Motor, Electric 1-H.P., D.C.	1	one	Pullman, Ill.	12
M-7-059	Motors, Electric 2-H.P., D.C.	4	one	Chicago, Ill.	12
M-7-060	Motors, Electric 5-H.P., A.C.	8	one	Kearny, N. J.	2
M-7-061	Lot Spare Parts for Above Motors	1		Washington, D. C.	18
M-7-062	Motor, Electric 1-H.P., A.C.	1		Camp Shelby, Miss.	6
M-7-063	Motor, Electric 15-H.P., A.C.	1		Washington, D. C.	18
M-7-064	Motor, Electric 40-H.P., D.C.	1		Columbus, Ohio	17
M-7-065	Motor, Electric 15-H.P., D.C.	1		Pullman, Ill.	12
M-7-066	Motors, Electric 15-H.P., D.C.	2	one	Rockford, Ill.	12
M-7-067	Motors, Electric 10-H.P., D.C.	2	one	Kearny, N. J.	2
M-7-068	Lot Electric Motor Parts 15-H.P., D.C.	1		Pullman, Ill.	12
M-7-069	Electric Motor Starting Box 3-H.P., D.C.	1		Philadelphia, Pa.	4
M-7-070	Motor, Electric 10-H.P., D.C.	1		Pullman, Ill.	12
M-7-071	Motor, Electric 45-H.P., D.C.	1		Pullman, Ill.	12
M-7-072	Motors, Electric 5-H.P., D.C.	2	one	Pullman, Ill.	12
M-7-073	Motor, Electric 5-H.P., D.C.	1		Pullman, Ill.	12
M-7-074	Motor, Electric 10-H.P., D.C.	1		Pullman, Ill.	12
M-7-075	Motor, Electric 40-H.P., D.C.	1		Pullman, Ill.	12
M-7-076	Generator, Engine Type 220-Kw., D.C.	1		Apply to	18
M-7-077	Generators, D.C. 15-Kw., D.C.	24	one	Washington, D. C.	18
M-7-078	Motors, Electric 15-H.P., D.C.	3	one	Rockford, Ill.	12
M-7-079	Motor, Electric 2-H.P., D.C.	1		Rockford, Ill.	12
M-7-080	Motor, Electric 50-H.P., D.C.	1		Rockford, Ill.	12
M-7-081	Motors, Electric 10-H.P., D.C.	3	one	Pullman, Ill.	12
M-7-082	Motors, Electric 35-H.P., A.C.	9	one	Columbus, Ohio	17
M-7-083	Lot Spare Parts for Above Generators 15-Kw., D.C.	1		Washington, D.C.	18
M-7-084	Motors, Electric 3-H.P., D.C.	16	one	Pullman, Ill.	12
M-7-085	Motors, Electric 7½-H.P., D.C.	2	one	Pullman, Ill.	12
	STEAM GENERATOR SETS				
M-7-046	50-Kw. Steam Generator Sets 96-H.P., D.C.	2	one	Kearny, N. J.	2
M-7-047	50-Kw. Steam Generator Sets, 96-H.P., D.C.	2	one	Kearny, N. J.	2
M-7-048	Steam Generator Sets, heavy duty	2	one	Schenectady, N. Y.	3
M-7-049	Lot Spare Parts for above	1		Schenectady, N. Y.	3
M-7-050	Steam Generator Set, heavy duty, 115-H.P.	1		Schenectady, N. Y.	3
M-7-051	Lot Spare Parts for above engine	1		Schenectady, N. Y.	3
M-7-052	Steam Generator Set, Automatic Engine, 96-H.P.	1		Schenectady, N. Y.	3
M-7-053	Engine Spares for above			Schenectady, N. Y.	3
M-7-054	Steam Generator Sets, 85-H.P. Skinner Steam Engine	1		New Cumberland, Pa.	16
M-7-055	Automatic Steam Engines, 35-H.P.	2	one	New Cumberland, Pa.	16
M-7-056	Automatic Steam Engines, 96-H.P.	2	one	New Cumberland, Pa.	16

Other Equipment

The following equipment is also included in Machinery and Engineering Materials List No. 7:

Wood-Working Machinery; Machine Tools, Gas Engines, Hoists and Engines, Hammers, Pumps, Compressors, Boilers, Electrical Accessories, Shears, Tanks, Constructors' Equipment, Laundry Machinery.

Detailed information will be given upon request to any of the Zone Supply Offices listed on the opposite page.

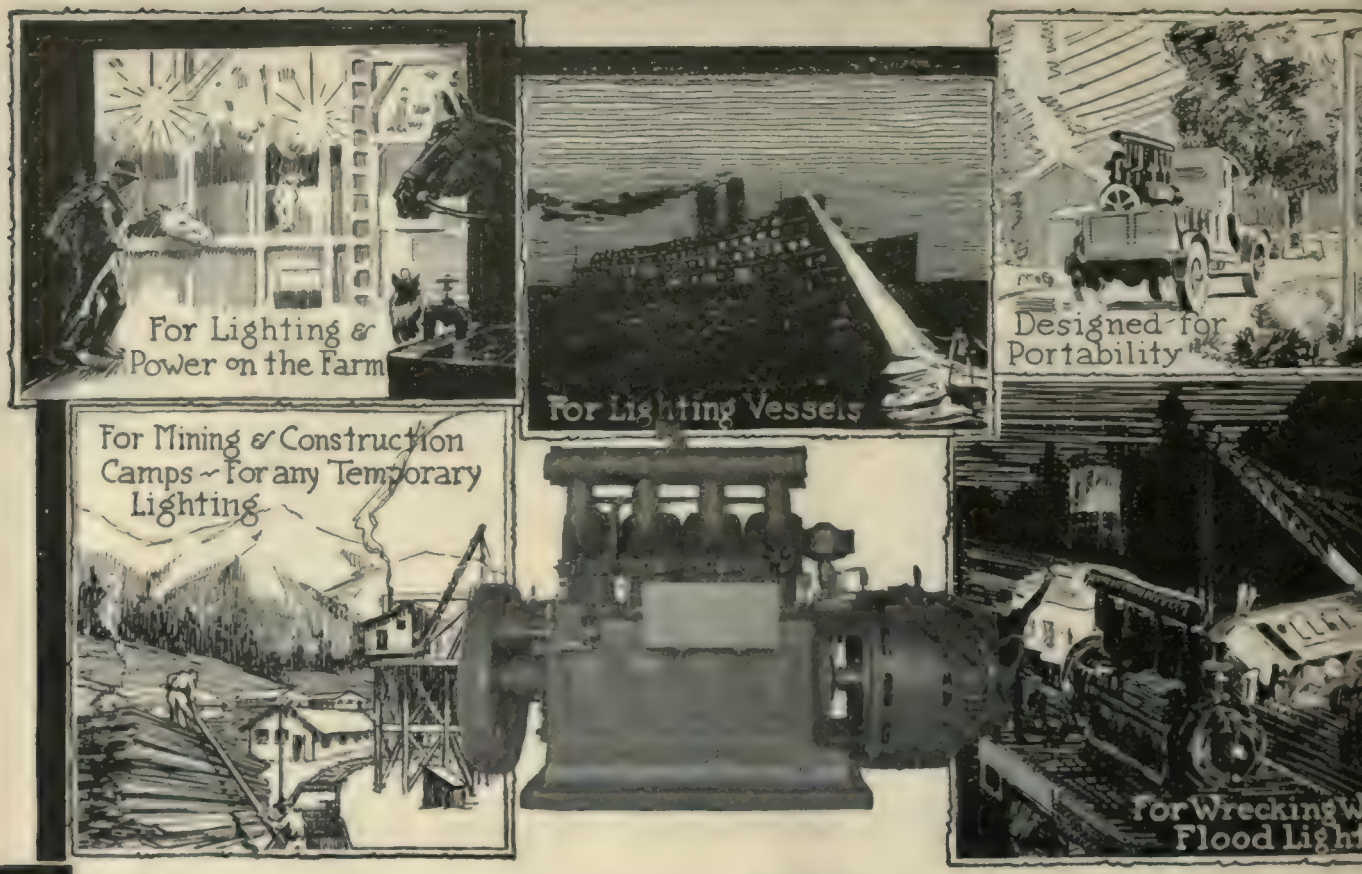
The Quartermaster Corps

is also advertising for sale in the Trade Publications covering the respective classes of materials,

Wire, Iron and Steel, Foodstuffs, Chemicals, Laundry Machinery, Road Builders, General Machinery, Clothing and Equipage, Hardware, Harness, Textiles, Raw Materials.

Bulletins giving full and complete information about any of these sales may be obtained by writing to any one of the Zone Supply Offices on the opposite page.

For information about Sales see opposite page



WAR DEPARTMENT Offers For Sale These

25 KW. Gasoline Electric

Have your own electric light plant

THE War Department, Quartermaster Corps, is offering for sale direct connected 25 kw. Gasoline—D.C. Electric Generator Sets. They are the standard Fortification type as manufactured by the General Electric Company for the Government and are made to Government design and specifications, representing the best engineering practice obtainable. The set is compact, portable, complete and easily operated. It is so well balanced that it may be operated from a truck, flat car or ordinary floor, from the deck of a boat or a dock. The outfit was designed to meet the Army need of making quick changes in location.

Portability is therefore one of its principal features.

It is provided with foundation bolts and may be attached to a foundation for permanent or semi-permanent use. It has a capacity with overload of 750—40 watt lamps.

Here are just a few of the many fields in which this set is particularly adaptable

Motion picture production; and in motion picture theatres. Railroading—for construction, emergency and wrecking purposes, for lighting yards and stations.

Mines, construction camps, villages and towns.

Steam and power boats, docks, fishing stations and canneries.

Amusement parks, skating rinks, summer and winter resorts.

Electric power and lighting companies—for emergency work and for preventing overloads.

Manufacturing plants, oil companies, etc.

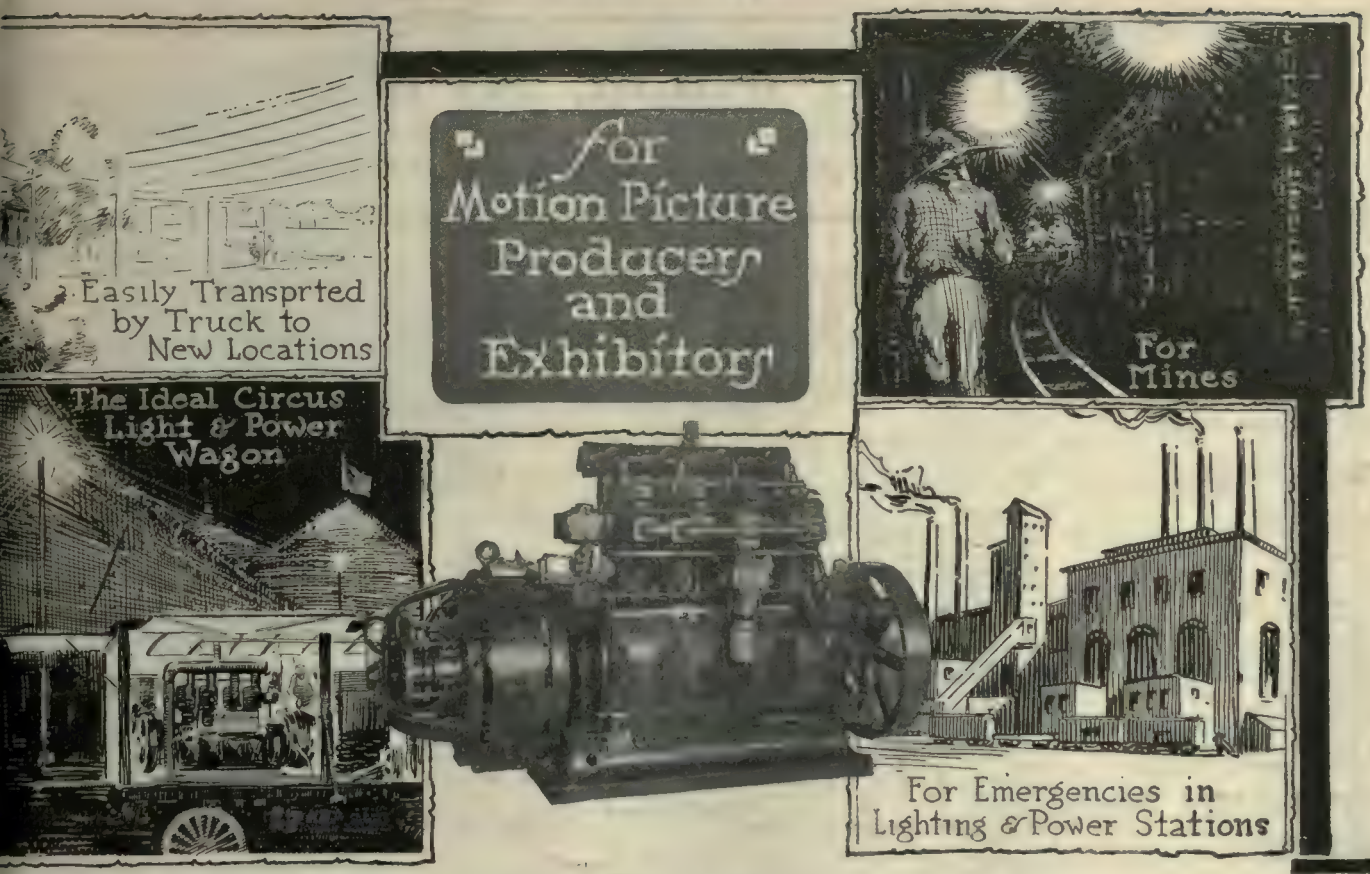
Convention halls, chautauquas, ice harvesting, country fairs, circuses and carnivals, for light and power wagons.

Motion Picture Producers will find these sets eminently adapted to the requirements of picture production. They can be readily transported by truck to "locations" otherwise difficult or inaccessible.

Electric Companies will find such a plant convenient and remunerative. It can be used quickly in case of emergency; for lighting purposes where motor load is not a conflicting factor; for unusual overloads or helping on peak loads. There should be many occasions also where such apparatus could be rented to advantage. Mounted on a wagon, it makes the ideal Circus Light and Power Plant

PRICE—2 WIRE-115V. UNIT COMPLETE—$3500.00 F.O.B. Schenectady New York

Opportunities like this do not last long



QUARTERMASTER CORPS
General Electric Type GM-12
Generator Sets

Get one of these "sets of a hundred uses"

For Either Temporary or Semi-Permanent Work such as conventions, chautauquas, carnivals, etc. The apparatus can be loaded upon a truck quickly and transferred to a new location at a minimum of time and expense.

Railways—This set can be installed upon a flat car and used with either arcs, incandescent or searchlights for flood lighting at night for clearing wrecks, etc. Such illumination eliminates the danger from fires which is ever present with gasoline or acetylene flares. It is particularly adapted for use in tunnel construction, relining or in cases of wrecks in tunnels.

In Mining Work—it will be found to be especially useful where liquid fuel is relied upon. Its portability eliminates the loss that would be involved with a permanent plant when works are abandoned or system changed.

In Saw Mills and Manufacturing Plants—it reduces the fire risk and obviates the necessity of keeping boiler fires at times of plant idleness.

For Summer and Winter Resort Use—where the season is short, overhead costs can be reduced as the plant may be transported and used for other purposes during off seasons, and does not require expensive attention. Once in operation it may be kept in operation with a minimum of care.

Oil Companies—find it particularly adapted for their uses in the fields and for pumping station work since it obviates fire risk.

A Booklet—containing complete detailed descriptions of the Generator Sets and Parts may be obtained upon application to any of the Zone Supply Offices here listed.

Send for Your Copy at Once.

Army Supply Base, Boston, Mass.; 461 8th Ave., New York City; 21st St. and Oregon Ave., Philadelphia, Pa.; Coca Cola Bldg, Baltimore, Md.; Transportation Bldg., Atlanta, Ga.; Army Bldg, 15th and Dodge Sts., Omaha, Neb.; Fort Mason, San Francisco, Cal.; 17th and F Sts., N. W., Washington, D. C.; Newport News, Va.; Jeffersonville, Ind., 1819 West 39th St , Chicago, Ill., 2nd and Arsenal Sts.; St. Louis, Mo., Poland and Dauphin Sts.; New Orleans, La.; San Antonio, Texas; New Cumberland, Pa.; Columbus, Ohio, or at the Surplus Property Division, Munitions Building, Washington, D. C.

Switchboards for these sets are also offered for sale—Price $190.00 each.

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Get YOUR ORDER in TODAY

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

Paints and Varnishes for Woodwork
National Ry. Appliance Co.

Paving Pitch
Barrett Co., The

Paving Material
American Brake Shoe & Fdry. Co.
Barrett Co., The

Pickups, Trolley Wire
Electric Service Supplies Co.
Ohio Brass Co.

Advertising, Street Car
Collier, Inc., Barron G.

Air Aftercoolers
Ingersoll-Rand Co.

Air Receivers
Ingersoll-Rand Co.

Ammeters
Weston Elec'l Instrument Co.

Anchors, Guy
Chance Co., The.
Electric Service Supplies Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Westinghouse Elec. & M. Co.

Ash Storage Tanks, Cast Iron
Green Engineering Company

Automobiles and Buses
Brill Co., The J. G.

Axle Straightaners
Columbia M. W. & M. I. Co.

Axles, Car Wheel
Bemis Car Truck Co.
Brill Co., The J. G.
Carnegie Steel Co.
Cambria Steel Co.
Midvale Steel & Ordnance Co.
St. Louis Car Co.
Standard Steel Works Co.
Westinghouse Elec. & M. Co.

Babbitt Metal
More-Jones Brass & Metal Co.

Babbitting Devices
Columbia M. W. & M. I. Co.

Badges and Buttons
Electric Service Supplies Co.
International Register Co., The

Batteries, Storage
Electric Storage Battery Co.

Bearings and Bearing Metals
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
More-Jones Brass & Metal Co.
St. Louis Car Co.
Westinghouse Elec. & M. Co.

Bearings, Center and Roller Side
Stucki Co., A.

Bells and Gongs
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
St. Louis Car Co.

Benders, Rail
Niles-Bement-Pond Co.
Wharton Jr. & Co., Wm.
Zelnicker, Walter A., Supply Co., Inc.

Boiler Cleaning Compounds
Johns-Manville Co., H. W.

Boiler Coverings
Johns-Manville Co., H. W.

Boilers
Babcock & Wilcox Co.

Boiler Tubes
National Tube Co.

Bond Testers
American Steel & Wire Co.

Bonding Apparatus
American Steel & Wire Co.
Electric Railway Improv. Co.
Electric Service Supplies Co.
Ohio Brass Co.
Rail Welding & Bonding Co.

Bonds, Rail
Electric Railway Improv. Co.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Rail Welding & Bonding Co.
Westinghouse Elec. & M. Co.

Bond Testers
Rail Welding & Bonding Co.

Book Publishers
McGraw-Hill Book Co., Inc.

Boring Tools, Car Wheel
Niles-Bement-Pond Co.

Brackets and Cross Arms. (See also Poles, Ties, Posts, Etc.)
Bates Expanded Steel Truss Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Hubbard & Co.
Lindsley Bros. Co.
Ohio Brass Co.

Brake Adjusters
National Ry. Appliance Co.
Westinghouse Traction Brake Co.

Brake Shoes
Amer. Brake Shoe & Fdry. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
St. Louis Car Co.

Brakes, Brake Systems and Brake Parts
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
General Electric Co.
National Brake Co.
St. Louis Car Co.
Safety Car Devices Co.
Westinghouse Traction Brake Co.

Bricks, Fire
Green Engingering Co.

Brooms, Track, Steel or Rattan
Zelnicker, Walter A., Supply Co., Inc.

Brushes, Carbon
General Electric Co.
Jeandron, W. J.
United States Graphite Co.
Westinghouse Elec. & M. Co.

Brushes, Graphite
United States Graphite Co.

Brush Holders
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.

Bushings, Case Hardened and Manganese
Bemis Car Truck Co.

Bushings, Graphite and Wooden
Bound Brook Oilless Bearing Co.

Cables. (See Wires and Cables)

Carbon Brushes. (See Brushes, Carbon)

Car Equipment. (For Fenders, Heaters, Registers, Wheels, etc., see those headings)

Car Trimmings. (For Curtains, Registers, Doors, Seats, etc., see those headings)

Car Panel Safety Switches
Westinghouse Elec. & Mfg. Co.

Cars, Passenger, Freight, Express, etc.
American Car Co.
Brill Co., The J. G.
Cambria Steel Co.
Kuhlman Car Co., G. C.
McGuire-Cummings Mfg. Co.
Midvale Steel & Ordnance Co.
National Ry. Appliance Co.
St. Louis Car Co.
Wason Mfg. Co.

Cars, Second Hand
Electric Equipment Co.

Car, Self-Propelled
Electric Storage Battery Co.
General Electric Co.

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Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.
More-Jones Brass & Metal Co.

Castings, Gray Iron and Steel
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Standard Steel Works Co.
Wharton Jr. & Co., Wm.

Castings, Malleable and Brass
Amer. Brake Shoe & Fdry. Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.

Catchers and Retrievers, Trolley
Electric Service Supplies Co.
Ohio Brass Co.
Wood Co., Chas. N.

Checking
Industrial Protective Co., The

Circuit Breakers
Automatic Reclosing Circuit Breaker Co.
Cutter Electrical & Mfg. Co., The
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps and Connectors for Wires and Cables
Anderson Mfg. Co., A. & J. M.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Cleaners and Scrapers—Track (See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.
Ohio Brass Co.

Clusters and Sockets
General Electric Co.

Coal and Ash Handling. (See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Coils, Armature and Field
Cleveland Armature Works
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Rome Wire Co.
Westinghouse Elec. & M. Co.

Coils, Choke and Kicking
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Coin-Counting Machines
Electric Service Supplies Co.
International Register Co., The
Johnson Fare Box Co.

Comelong
Bush Electric Co.

Commutator Slotters
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Commutator Truing Devices
General Electric Co.

Commutator or Parts
Cameron Electrical Mfg. Co.
Cleveland Armature Works
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Eureka Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Compressors, Air
General Electric Co.
Ingersoll Rand Co.
Westinghouse Trac. Brake Co.

Compressors, Gas
Ingersoll Rand Co.

Condensers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Conduit Fittings
Chicago Fuse Mfg. Co.

Connectors, Solderless
Frankel Connector Co.
Westinghouse Elec. & Mfg. Co.

Controller Fingers
Russell Mfg. Co.

Controllers or Parts
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Johns-Manville Co., H. W.
Russell Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Controller Regulators
Elec. Service Supplies Co.

Controlling Systems
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Converters, Rotary
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Conveyors, Belt
Portable Machinery Co.

Conveyors, Coal and Ash
Green Eng. Co.
Portable Machinery Co.

Conveyors, Portable
Portable Machinery Co.

Conveying and Hoisting Machinery
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Green Eng. Co.
Portable Machinery Co.

Copper Wire
Anaconda Copper Mining Co.

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Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Roebling's Sons Co., John A.
Samson Cordage Works

Cord Connectors and Couplers
Electric Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.

Couplers, Car
Brill Co., The J. G.
Ohio Brass Co.
Van Dorn Coupler Co.
Westinghouse Trac. Brake Co.

Cranes
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The

Creosoting. (See Wood Preservatives)

Cross Arms. (See Brackets)

Crossing Foundations
International Steel Tie Co.

Crossing Signals. (See Signals, Crossing)

Crossings, Track. (See Track, Special Work)

Culverts
Canton Culvert & Silo Co.

Curtains and Curtain Fixtures
Brill Co., The J. G.
Electric Service Supplies Co.
St. Louis Car Co.

Cutouts
Chicago Fuse Mfg. Co.

Dealers' Machinery
Archer & Baldwin
Cleveland Armature Works
Electric Equipment Co.
Foster Co., L. B.
Griswold Machine Co., Geo. M.
Hyman Michaels Co.
MacGovern & Co., Inc.
Zelnicker Supply Co., Inc., Walter A.

Derailing Devices. (See also Track Work)
Cleveland Frog & Crossing Co.
Wharton Jr. & Co., Wm.

Destination Signs
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Electric Service Supplies Co.



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Weston Indicating Instruments include a great variety of groups for portable or switchboard service on A. C. or D. C. Circuits. Instruments designed expressly for testing and laboratory use, for motor car and boat electrical systems, and many others for special purposes. Write for Bulletins or Catalogs describing those which interest you.

—for Accurate Testing

It is often necessary to conduct power tests under conditions that are far from favorable.

Here is a portable instrument that fulfills the most exacting requirements on both A. C. and D. C. circuits. The

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MODEL 310 PORTABLE

Single-Phase and D. C. Wattmeter

is extremely accurate (guaranteed within one-fourth of 1% of full scale value.)

It may be used on A. C. circuits of any commercial frequency and has a large overload capacity. Other characteristics are: low moment of inertia; effective damping and shielding; and the legibility and remarkable uniformity of the hand-calibrated scale.

Weston Indicating Instruments have been for thirty-two years the accepted standard of the world.

Weston Electrical Instrument Co.

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Branch Offices in All Principal Cities of the United States and throughout the World.

A Dependable Outlet for Enamel Magnet Wire

For those who require better insulation than the ordinary cotton and silk covering affords. This new Enamel wire will give the desired results.

When used with cotton and silk covering it gives a much increased insulation value.

When used without cotton or silk covering it takes up much less space and has good insulation value.

Will not crack when bent and will not get brittle when subjected to high temperatures.

Write for details.

Independent Lamp & Wire Co., Inc.

OFFICES: 1737 Broadway, New York

FACTORIES: York, Pa., and Weehawken, N. J.

Be Independent of Coil Trouble use SALAMANDER Pure Asbestos

During the rush hours when your motors are greatly overloaded and become excessively hot you need not have any fear of burnouts if the coils are insulated with Salamander Pure Asbestos. It will not burn no matter how hot it gets.

Send us your burnout coils and let us rewind them for you. We are in a position to rush work, thereby helping you out of your difficulties.

Independent Lamp & Wire Co., Inc.

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WHAT AND WHERE TO BUY

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Williams & Co., J. H.

Torches, Acetylene. (See Cutting Apparatus)

Towers and Transmission Structures
Archbold-Brady Co.
Bates Expanded Steel Truss Co.
Westinghouse Elec. & Mfg. Co.

Track, Special Work
Barbour-Stockwell Co.
Cleveland Frog & Crossing Co.
Columbia M. W. & M. I. Co.
Indianapolis Switch & Frog Co.
New York Switch & Crossing Co.
Ramapo Iron Works
St. Louis Frog & Switch Co.
Wharton Jr. & Co., Wm.

Transfer Tables
Archbold-Brady Co.

Transfers. (See Tickets)

Transformers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Treads, Safety, Stair, Car Step
American Mason Safety Tread Co.
Universal Safety Tread Co.

Trolley Bases
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co
Nuttall Co., R. D.
Ohio Brass Co.

Detective Service
Wish Service P. Edward

Turning, Lathe
Williams & Co., J. H.

Door Operating Devices
Consolidated Car Heating Co.
National Pneumatic Co., Inc.
Safety Car Devices Co.

Doors, Asbestos
Johns-Manville Co., H. W.

Doors and Door Fixtures
Brill Co., The J. G.
General Electric Co.
Hale & Kilburn Corp.

Doors, Folding Vestibule
National Pneumatic Co., Inc.

Draft Rigging. (See Couplers)

Drills, Rock
Ingersoll-Rand Co.

Drills, Track
American Steel & Wire Co.
Electric Service Supplies Co.
Niles-Bement-Pond Co.
Ohio Brass Co.

Drinking Cups, Sanitary Paper
Individual Drinking Cup Co., Inc.

Dryers, Sand
Electric Service Supplies Co.
Zelnicker Supply Co., Inc., Walter A.

Electrical Wires and Cables
Roebling's Sons Co., J. A.

Engineers, Consulting, Contracting and Operating
Archbold-Brady Co.
Arnold Co. The
Bylesby Engineering & Management Corp'n
Clark Management Corp., E. W.
Engel & Heyenor
Fouatel Robert M.
Ford, Bacon & Davis
Holst Englehardt W.
Jacobs & Co., J. L.
Kelly Cooke & Co.
Republic Engineers, Inc
Richey Albert S
Robinson & Co. Dwight P
Sanderson & Porter
Scofield Engineering Co.
Stone & Webster
White Companies, The J. G
Woodmansee & Davidson Engineering Co.

Engines and Pumps
Fairbanks Co., The

Engines, Gas and Oil
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Engines, Steam
Westinghouse Elec. & Mfg. Co.

Fare Boxes
Brill Co. The J. G.
Cleveland Fare Box Co.
Johnson Fare Box Co.
National Railway Appliance Co

Fences, Woven Wire and Fence Posts
American Steel & Wire Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Cleveland Fare Box Co.
Consolidated Car Fender Co.
Electric Service Supplies Co.
Star Brass Works

Fibre and Fibre Tubing
Johns-Manville Co., H. W.
Westinghouse Elec. & Mfg. Co.

Field Coils. (See Coils)

Filters, Water
Scaife & Sons Co., Wm. B.

Fire Extinguishing Apparatus
Castle, Inc., James M.
Johns-Manville Co., H. W.

Fireproofing Material
Johns-Manville Co., H. W.

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Crouse-Hinds Co.
Electric Service Supplies Co.

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American Mason Safety Thread Co.
Johns-Manville Co., H. W.

Flooring, Grating
Irving Iron Works

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Carnegie Steel Co.
Columbia Machine Works & M. I. Co.
Eureka Co.
Standard Forgings Co.
Standard Steel Works Co.
Williams & Co., J. H.

Frogs, Track. (See Track Work)

Furnaces. (See Stokers)

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Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Multiple Electric Products Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co., J. W.

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Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
General Electric Co.

Fuse, Removers
Bush Electric Co.

Gages, Oil and Water
Ohio Brass Co

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Power Specialty Co.
Westinghouse Traction Brake Co

Gas-Electric Cars
General Electric Co.

Gas Producers
Westinghouse Elec. & Mfg. Co.

Gates, Car
Brill Co., The J. G.

Gear Blanks
Carnegie Steel Co.
Standard Steel Works Co.

Gear Cases
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Electric Service Supplies Co.
Westinghouse Elec. & Mfg. Co.

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General Electric Co
National Railway Appliance Co
Nuttall Co., R. D.
Tool Steel Gear & Pinion Co.

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General Electric Co.

Generators
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Westinghouse Elec. & Mfg. Co

Gongs. (See Bells and Gongs)

Grates, Chain
Green Eng. Co

Greases. (See Lubricants)

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Indianapolis Switch & Frog Co.
Metal & Thermit Corp
Railway Track-work Co

Grinding Blocks and Wheels
Railway Track-work Co.

Guards, Trolley
Electric Service Supplies Co.
Ohio Brass Co

Harps, Trolley
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
More-Jones B. & M. Co
Nuttall Co., R. D.
Star Brass Works

Headlights
Crouse-Hinds Co
Electric Service Supplies Co
General Electric Co.
Ohio Brass Co.
St. Louis Car Co.

Heaters, Car (Electric)
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
National Ry. Appliance Co.
Smith Heater Co., Peter

Heaters, Car, Hot Air and Water
Cooper Heater Co.
Smith Heater Co., Peter

Heaters, Car (Stove)
Electric Service Supplies Co.
Smith Heater Co., Peter

Hoists and Lifts
Columbia M. W. & M. I. Co
Ford-Chain Block Co.
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The

Hose
Ingersoll-Rand Co.

Hose, Bridges
Ohio Brass Co.

Hose, Pneumatic & Fire
Johns-Manville Co., H. W.

Hydraulic Machinery
Niles-Bement-Pond Co.

Inspection
Electrical Testing Lab's

Instruments, Measuring, Testing and Recording
Economy Electric Devices Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Insulating Cloth, Paper and Tape
Belden Mfg. Co.
General Electric Co.
Johns-Manville Co., H. W.
Westinghouse Elec. & Mfg. Co.

Insulations. (See also Paints)
Anderson M. Co., A. & J. M.
Electric Ry. Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Johns-Manville Co., H. W.
Mitchell-Rand Mfg. Co
Westinghouse Elec. & Mfg. Co.

Insulators. (See also Line Material)
Anderson M. Co., A. & J. M.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Insulator Pins
Electric Service Supplies Co
Hubbard & Co

Jacks. (See also Cranes, Hoists and Lifts)
Brill Co. The J. G.
Buckeye Jack Mfg. Co.
Columbia M. W. & M. I. Co
Templeton, Kenly Co., Ltd.

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Carnegie Steel Co
Rail Joint Co
Zelnicker Supply Company, Inc., Walter A.

Journal Boxes
Bemis Car Truck Co
Brill Co., J. G.

Junction Boxes
Johns-Manville Co., H. W.

Laboratories
Electric Testing Lab's

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Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Arc and Incandescent. (See also Headlights)
Anderson M. Co., A. & J. M.
General Electric Co.
Westinghouse Elec. & Mfg. Co

Lamps, Signal and Marker
Ohio Brass Co

Lathe Attachments
Williams & Co., J. H.

Lathes, Car Wheel
Niles-Bement-Pond Co

Lightning Protection
Anderson M. Co., A. & J. M.
Electric Service Supplies Co
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co

Line Material. (See also Brackets, Insulators, Wires, etc.)
Anderson M. Co. A. & J. M.
Archbold-Brady Co.
Chance Co., The
Columbia M. W. & M. I. Co
Drew Electric & Mfg. Co.
Electric Railway Equipment Co
Electric Service Supplies Co
Eureka Co.
General Electric Co
Hubbard & Co.
Johns-Manville Co., H. W
More-Jones B. & M. Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co

Loaders, Wagon, Truck or Car
Portable Machinery Co.

Locomotives, Electric
Brill Co., The J. G.
General Electric Co.
McGuire-Cummings Mfg. Co
Westinghouse Elec. & Mfg. Co

Lubricating Engineers
Galena-Signal Oil Co.

Lumber. (See Poles, Ties, etc.)

Lubricants, Oil and Grease
Galena-Signal Oil Co

Machine Tools
Columbia M. W. & M. I. Co
Fairbanks Co., The
Niles-Bement-Pond Co.

Turbine Work
Columbia M. W. & M. I. Co
Holden & White, Inc.

Mats
Johns-Manville Co., H. W

Meters, Car, Watt-Hour
Economy Electric Devices

Meters. (See Instruments)
Electric Service Supplies Co

Mirrors for Motormen
Drew Elec. & Mfg. Co.

Motormen's Seats
Electric Service Supplies Co
Wood Co., Chas. N

Motors, Electric
Westinghouse Elec. & Mfg. Co

Motors and Generators, Sets
General Electric Co.

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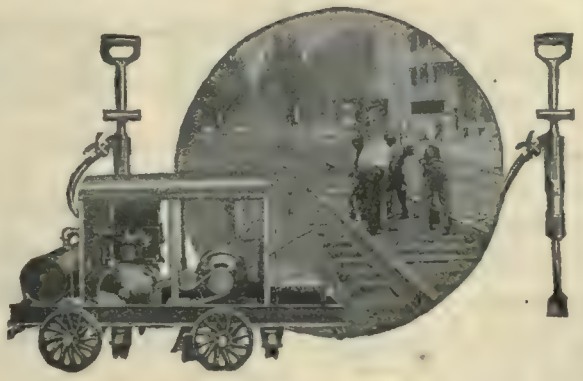
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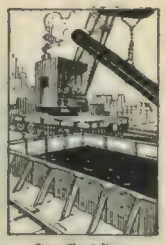
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Dipping Process

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A timely talk of interest to all users of structural wood



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—Theodore Roosevelt.

resources that are so necessary to national prosperity, and even safety,—because they may be employed without costly preparations by anyone under any condition. Carbosota Creosote Oil is the salvation of the lumber industry. It can be obtained and properly used by every consumer of wood.

Every lumber distributor, each consumer of structural wood, the architect and the engineer, are in duty bound to employ and urge the use of every available and practical means of fighting wood decay, not only because of the self-interest in the resulting profit, but also because of the directly beneficial influence upon the common weal.

Treating Poles

The average life of untre... poles is between ... depending ... locality ... one hundr... size cedar ... and one-h... contain... consid... such as ... evident ... these cedar ... years (whi... or to...

changes in design and proper treatment with Carbosota. Surveys by our experts may be arranged for where necessary.

Saving Mill Roof Decks

There are few industries where greater need exists for creosoted wood than in paper and textile mills. High humidity in machine rooms and weave sheds causes rapid decay of roof boards and timbers. The Open Tank process comprising hot and cold treatment in Carbosota Creosote Oil will double the life of lumber subject to such severe conditions.

Farmers Need It

THE rural com... use are by far the ... largest bui... aggregate ...

Immediate Conservation of Timber



Shaving ground line area of poles.

Popularizing Wood Preservation is a national service. This full page advertisement which appears in the March 27th issue of the Saturday Evening Post is the first step in a nation-wide campaign to further the economical use of timber by equalizing the natural and mechanical life through creosoting.

Address nearest office for free folder No. 406, about carbosoting poles by non-pressure treatments.

Green wood cannot be effectively creosoted by non pressure processes. It should be air-dry. In regions of moist, warm climate, wood of some species may start to decay before it can be air-dried. Exception should be made in such cases and treatment modified accordingly.

Barrett Carbosota Grade-One Liquid Creosote Oil

The Barrett Company

New York, St. Louis, Richmond, Johnstown, Columbus, Lebanon, Salt Lake City, Chicago, Birmingham, Cleveland, Latrobe, Cincinnati, Bethlehem, Bangor, Philadelphia, Seattle, Kansas City, Pittsburgh, Minneapolis, Duluth, Boston, Washington, Peoria, Dallas, Atlanta, Youngstown, New Orleans, Milwaukee, Baltimore, Buffalo, Nashville, Toledo, Detroit, Elizabeth

THE BARRETT COMPANY, LIMITED, St. John, N. B., Halifax, N. S., Montreal, Toronto, Winnipeg, Vancouver, Sydney, N. S.



Quality Trolley Wheels and Harps

Like all other Columbia products the trolley wheels and trolley harps manufactured by us have as their motto Quality.

Quality first, last and always. This means to our customers that they can be assured the best the market can afford.

Our wheels and harps are made of the very best metals that can be obtained. Special attention has been given to get long wear and good lubrication. This means the elimination of high maintenance and numerous tie ups due to defective trolley harps and wheels.

Let us hear from you. We want to help you.

Columbia Machine Works & Malleable Iron Co.

Atlantic Ave. and Chestnut St.
Brooklyn, N. Y.

A. A. GREEN, Sales Mgr.,
60 Church St., N. Y. C.

J. L. WHITTAKER,
141 Milk St., Boston, Mass.

E. ALLISON THORNWELL
1026-7 Atlanta Trust Bldg.,
Atlanta, Ga.



TOOLS

Armature and axle straighteners
Armature shaft straighteners
Armature buggies and stands
Babbitting molds
Banding and heading machines
Car hoists
Car replacers
Coil taping machines for armature leads
Coil winding machines
Pinion pullers
Pit jacks
Signal or target switches
Tension stands

CAR EQUIPMENT

Armature and axle bearings
Armature and field coils
Bearings (axle and armature)
Brush-holders and brush-holder springs
Brake, door and other handles
Brake forgings, riggings, etc.
Car trimmings
Commutators
Controller handles
Forgings of all kinds
Gear cases (steel or malleable iron)
Grid resistors
Third-rail shoe beams and accessories
Trolley poles (steel) and wheels

Maximum

Birney Safety Cars will give satisfaction, but to obtain maximum results—the greatest to be had—one fundamental principle must be followed.

Increase the number of car units on your lines, giving a more frequent service, and there will be a corresponding increase in patronage that will more than warrant the installation.

Write for copy of Brill Publication No. 245. It gives actual figures of results on many properties.

BIRNEY SAFETY CAR



THE J. G. BRILL COMPANY

Philadelphia, Pa.

AMERICAN CAR CO., St. Louis, Mo.
G. C. KUHLMAN CAR CO., Cleveland, Ohio.
WASON MANFG. CO., Springfield, Mass.

The air compressor for light weight cars



FORT WORTH TEXAS





HOT SPRINGS ARKANSAS



MADISON WISCONSIN

CP-25

Motor-Driven Compressor designed, after careful study of modern electric railway requirements, for reducing stop costs.



GARY INDIANA

GENERAL ELECTRIC COMPANY

General Office, Schenectady, N.Y.

ELECTRIC RAILWAY JOURNAL





HOUSTON LYCEUM
& [illegible] LIBRARY

Phono-Electric is used for overhead construction by railways that operate on the basis of service first. "Service First" means absence of traffic disturbances — which means ultimate economy.

Phono-Electric gives "Service First" because it is made to withstand hard knocks without crystallization—high operating temperatures do not cause permanent elongation—and it wears away but slowly under the heaviest traffic.

Make a profitable experiment at your point of hardest service, try

Phono-Electric

Bridgeport Brass Company
Bridgeport Connecticut



In Brooklyn

Westinghouse Safety Car Equipments

have rendered uninterrupted service since their installation, several months ago, notwithstanding the recent storm "epidemic" that tied up many railway systems along the Atlantic coast.

Westinghouse Safety Car Motors

are performing in many cities, large and small, with the same degree of reliability just demonstrated in Brooklyn.



W
WESTINGHOUSE ELECTRIC

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
EAST PITTSBURGH, PA.

Westinghouse

Vol. 55, No. 14 New York, April 3, 1920 *Pages 679-734*

Electric Railway Journal

H. W. BLAKE, *Editor*

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JACKSON FINDS

There's Wisdom in the Use of Safety Cars

Early in June, 1919, the Jackson Railway & Light Company, Jackson, Tenn., began *genuine* Safety Car operation. Hardly a month had elapsed before we received the following letter from the delighted user:

JACKSON RAILWAY & LIGHT COMPANY

Mr. C. P. Cass, President,
Safety Car Devices Company,
Boatmen's Bank Building, St. Louis, Mo.

Jackson, Tenn., July 25, 1919.

My Dear Mr. Cass:

So far our new Safety Cars have been very satisfactory indeed. They are *very popular with the public and our men,* and we have had no objection from the city officials.

We have been able to *speed up our schedules,* and there is no doubt of the fact that the cars have *increased earnings.*

Very truly yours,
(Signed) JOHN WISDOM, *General Superintendent.*

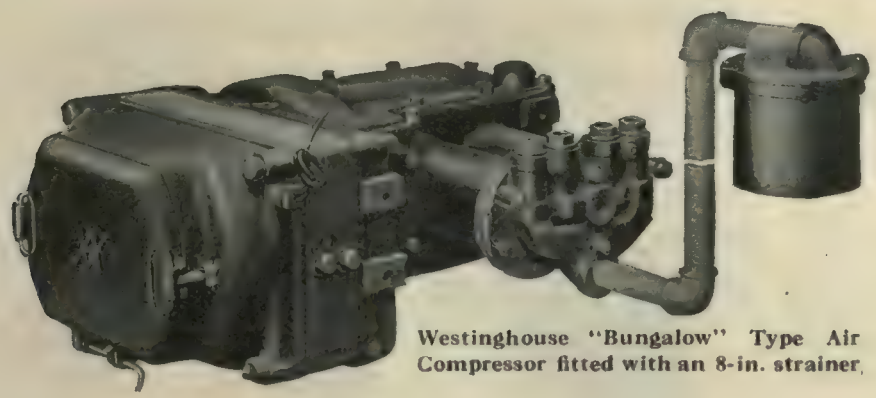
Note the portions of Mr. Wisdom's letter that we have taken the liberty of italicizing. It's wonderful how all the fancied objections to Safety Car operation vanish into thin air when operation actually begins. And at Jackson, Tenn., it is the car operators themselves who are most pleased because they had never used air brakes before. But the use of air brakes is only one feature of the making of a Safety Car. It is not a 100 per cent Safety Car unless it is equipped with automatic, laborless apparatus, so interlocked that, regardless of the illness, or distraction of the operator, the power will be cut off instantaneously, the air brakes and sander applied immediately thereafter, and the doors unlatched for safe and easy exit. *Furthermore,* it is a Safety Car only when the doors must be closed and the step folded before the car can start, and when the air brake must be applied before the doors are opened and the step lowered in bringing the car to a service stop.

SAFETY CAR DEVICES COMPANY

***Main Office*—Boatmen's Bank Building, ST. LOUIS**

CHICAGO Railway Exchange Building
WASHINGTON Munsey Bldg.
NEW YORK City Investment Building
PITTSBURGH Westinghouse Building
CANADA—Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Efficient maintenance of the Air Compressor is forwarded by providing a good Air Strainer



Westinghouse "Bungalow" Type Air Compressor fitted with an 8-in. strainer.

A Good Air Strainer

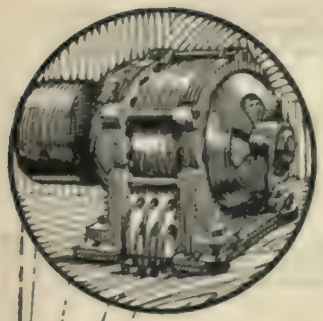
must be one which, while performing its function of straining the air being drawn into the compressor, will not restrict and reduce the intake of air at the strainer, either by insufficient screen area or by clogging up of the strainer. These two evils, common to air strainers, are avoided in the Westinghouse 8-inch type. Its large screening area permits a gentle flow of air to the compressor, and its practical construction makes easy the process of disassembling to remove collected dirt.

Air Brake Building Our Business For a Lifetime

Westinghouse Traction Brake Company

General Offices and Works: Wilmerding, Pa.

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Rome-Wire

The Symbol of
Efficiency in Electrical Conductors



HOT ROLLED COPPER AND BRONZE RODS

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Round, square and rectangular, plain and tinned

COPPER AND BRONZE TROLLEY WIRES
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POWER CABLES
Solid and Stranded

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MAGNET WIRE
Round, square and rectangular
cotton covered
silk covered
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enamel and cotton
enamel and silk



POLISHED COPPER PIANO COVERING WIRE

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DECK CABLE

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starter cable, lightning wire
horn wire

ROME WIRE CO.
ROME, N.Y.
U.S.A.

All Operations from Wire Bar to Finished Product in this Plant

O-B PRODUCTS

Quality First



O-B Type F-3 Compressed Terminal Bond—Patented

Rail Bonds Belong in the Most Abbreviated Budget

You encourage expense when you leave rail bonds out of the budget.

How much does it save when subnormal voltage, caused by neglected bonding, results in burnt out armatures?

How much does it save when people fuss, fume and walk while motors limp below speed and capacity on insufficient voltage?

How much does it save to pay for power which leaks away through a poor return?

The tighter money is, the more essential it is that you have good bonds.

O-B Bonds are good bonds.

The Return Circuit is a compact, straight-arm message about bonding. Among other things it describes two convenient ways to find defective bonds. Send for a copy.

The Ohio Brass Company

Mansfield, Ohio

New York Philadelphia Pittsburgh Chicago Los Angeles San Francisco



O-B Type ST-2 Gas Weld Bond. (Patented)

For installation by Oxy-acetylene process.



O-B Type AW-3 Bond. (Patented)

For installation by Arc Weld Process. May be used with almost any electric welding machine now on the market.



NIAGARA FALLS, NEW YORK



You Can Sell Your City a "White Way" too

AT Niagara Falls, New York, the electric railway company and the city authorities got together and pooled interests in the idea of creating a real "white way"—a main thoroughfare whose brilliant night lighting would mirror forth the true progressive spirit of the community.

And the "White Way" came into being in a very interesting, practical way. "Elreco" Combination Lighting and Trolley Wire Poles, of tubular steel construction, were installed.

These handsome fixtures took the place of the former unsightly, uneconomical wooden trolley poles, and also of the old-time street-lighting fixtures—thus reducing the number of obstructions on the curb line as well as providing the generous illumination desired.

It is a simple matter for the street railway company to start action in a matter like this; and once started the popularity of the scheme will carry it through very quickly, because it is good business for all concerned.

Write for Catalog "F," showing reproductions from actual photographs of "Elreco" Combination Railway and Lighting Poles installed in many cities. It will stir your enthusiasm!

Electric Railway Equipment Company

Cincinnati, Ohio

30 Church Street, New York City



When They Planned 1920 Track Construction They Reasoned Like This:

THERE is a type of paved street track construction that eliminates half of the concrete usually required.

Its fundamental principle is the economical distribution of steel in concrete with both so proportioned to obtain all their inherent advantages.

Eleven years of experience of other companies on hundreds of miles of paved street track with this design has stamped it with the mark of success.

One of its units required for six feet of track costs only 5 cents a foot more than the doubtful wooden ties that are now being offered to us.

Therefore, we will use this construction on our 1920 work.

"They" are our new customers and the construction is *Steel Twin Tie Track.*

THE INTERNATIONAL STEEL TIE COMPANY

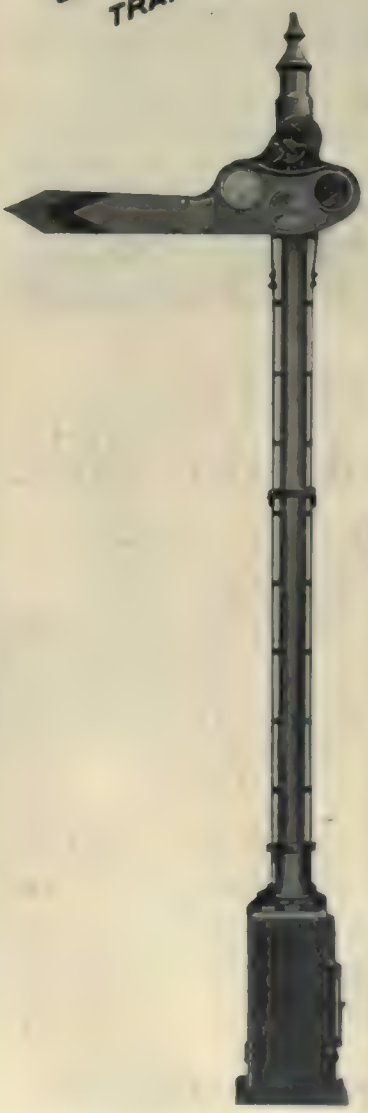
Manufacturers of Steel Twin Ties and Crossing Foundations

GENERAL SALES OFFICE AND WORKS: CLEVELAND, OHIO

Steel Twin Tie Track

The T.D.B. SYSTEM OF SIGNALING

TRAFFIC DIRECTION BLOCK



(Bulletin 69—T. D. B. System—on request).

Particular attention is called to the following summary of results to be obtained by the use of this system. This will doubtless appeal to the executive, operating and engineering departments of all interurban railways.

FIRST:—MAXIMUM PROTECTION:—Each car has at all times one or two stop signals protecting it at the rear as well as head-on.

SECOND:—MAXIMUM SPEED:—A proceed signal means that the block is unoccupied.

THIRD:—SIMPLICITY OF OPERATION:—Each signal gives but two indications, stop and proceed. All apparatus is operated automatically; therefore, trainmen do not need to manipulate any part of the signal system. All cars receive the same indication to pass into a block.

FOURTH:—FACILITY OF OPERATION:—A car receiving a clear signal can proceed without delay. Each block is a unit with clearly defined limits; the absence of preliminaries insures that a car in one block does not affect other cars in or approaching adjoining blocks. A car may, therefore, at any time proceed promptly to a siding or meeting point.

FIFTH:—SIMPLICITY OF RULES:—There are only two indications, **stop** and **proceed**, which are so easily understood that trainmen are favorably impressed and appreciate the fact that they can be observed without difficulty or confusion.

SIXTH:—SHORTEST POSSIBLE HEADWAY UNDER FULL PROTECTION:—Opposing or following cars are spaced a minimum safe distance apart. Under a system requiring preliminaries the spacing is increased at certain places by a distance equal to the length of the preliminary without securing additional safety. The fact that the length of the preliminary does not always bear a fixed relation to the length of the block and that the preliminary may be at either end, means that all signals do not give the same information.

SEVENTH:—HIGH EFFICIENCY:—Standard apparatus and simple controlling circuits are used throughout.

EIGHTH:—ADAPTABILITY TO CONDITIONS:—This system is applicable to all track and traffic conditions.

The Union Switch & Signal Co.

SWISSVALE, PA.

Trade Mark

City Investing Bldg. NEW YORK

McGill Building MONTREAL

Railway Exchange Bldg. ST. LOUIS, MO.

Peoples Gas Bldg. CHICAGO

So. Pacific Building SAN FRANCISCO

Trade Mark

Represented by the GENERAL ELECTRIC CO. in Australasia, South Africa and Argentina



Do not risk complete destruction or serious damage to your apparatus by lightning. It has doubled in value since you last considered lightning protection seriously. Replacement or repairs mean great expense and long interruption of service.

Garton-Daniels Lightning Arresters have proved their efficiency for 29 years. Use them always for your important station apparatus.

Write for Bulletin No. 163.

ELECTRIC SERVICE SUPPLIES CO.

Manufacturer of Railway Material and Electrical Supplies

PHILADELPHIA
17th and Cambria Sts.

NEW YORK
50 Church Street

CHICAGO
Monadnock Building

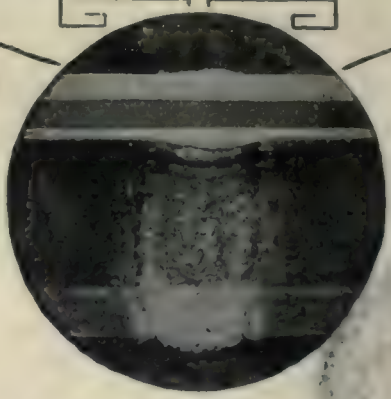
TRAVELS TO TOWNS WHERE THERMIT INSERT RAIL WELDING TERMINATED TRACK TROUBLES





Thermit Insert Rail Welding by the Pittsburgh Railways





PITTSBURGH

Pittsburgh's smoke makes the Pittsburghians spend millions of extra dollars annually on laundry bills. What a waste!

But there's no waste about the thousands of THERMIT INSERT RAIL WELDS installed throughout Pittsburgh and vicinity during the last several years. Out of approximately 5600 welds made by the Pittsburgh Railways the breakage reported has been less than 1/10 of 1% *and no signs of cupping can be observed at all!*

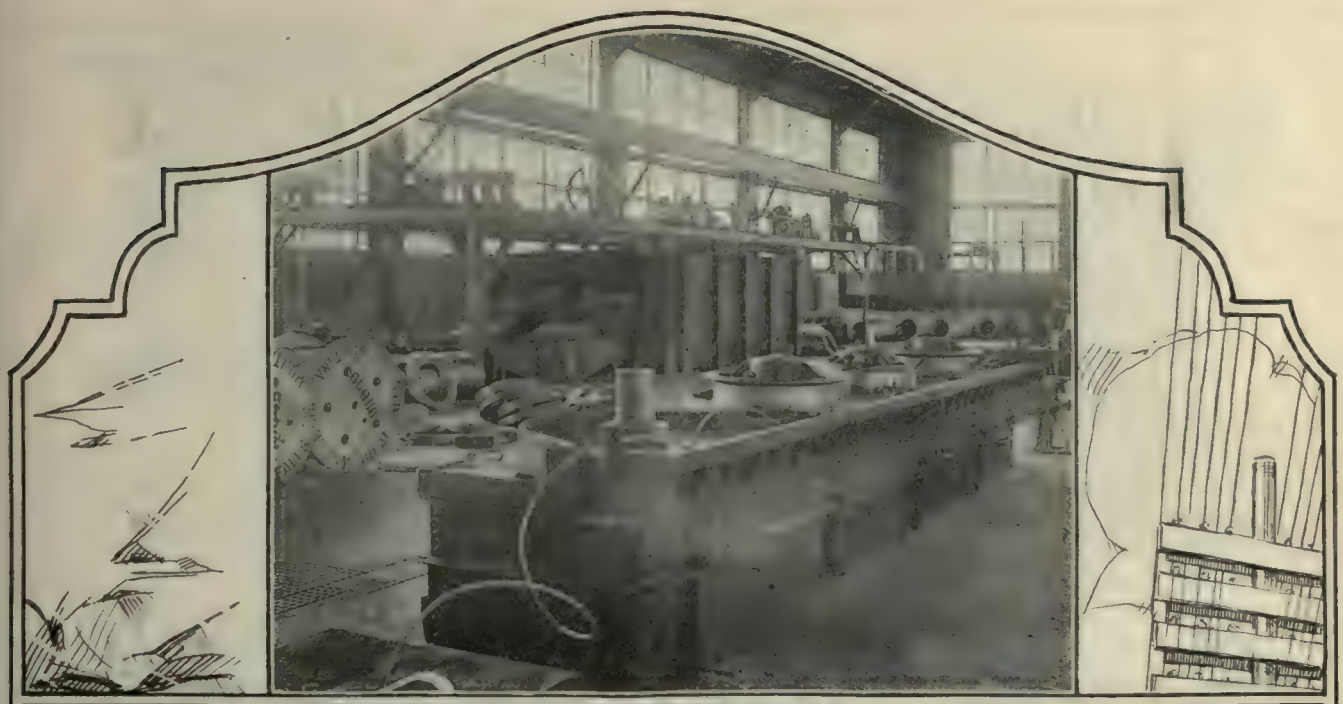
Can any other type of joint, welded or mechanical, touch this low maintenance, non-cupping record? We guess not!

Send for Rail Welding Pamphlet 1232.

METAL & THERMIT CORPORATION
120 Broadway
Chicago Pittsburgh San Francisco Toronto



"Next Stop, Youngstown!"



ANACONDA
Copper Wire



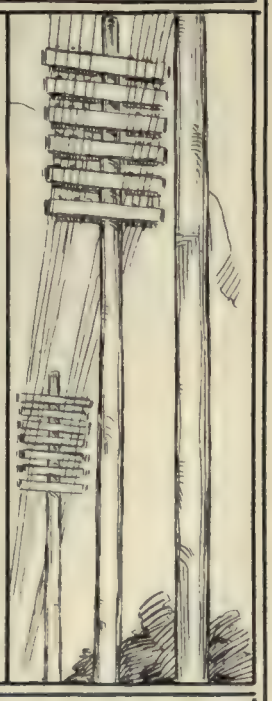
Anaconda Copper Wire is made from the famous B & M Brand Copper Bars in our own mills, under the direct supervision of Anaconda experts.

The fact that B & M Brand Copper contains less than 1/100 of 1% metallic impurities is sufficient guarantee of the purity of the finished product.

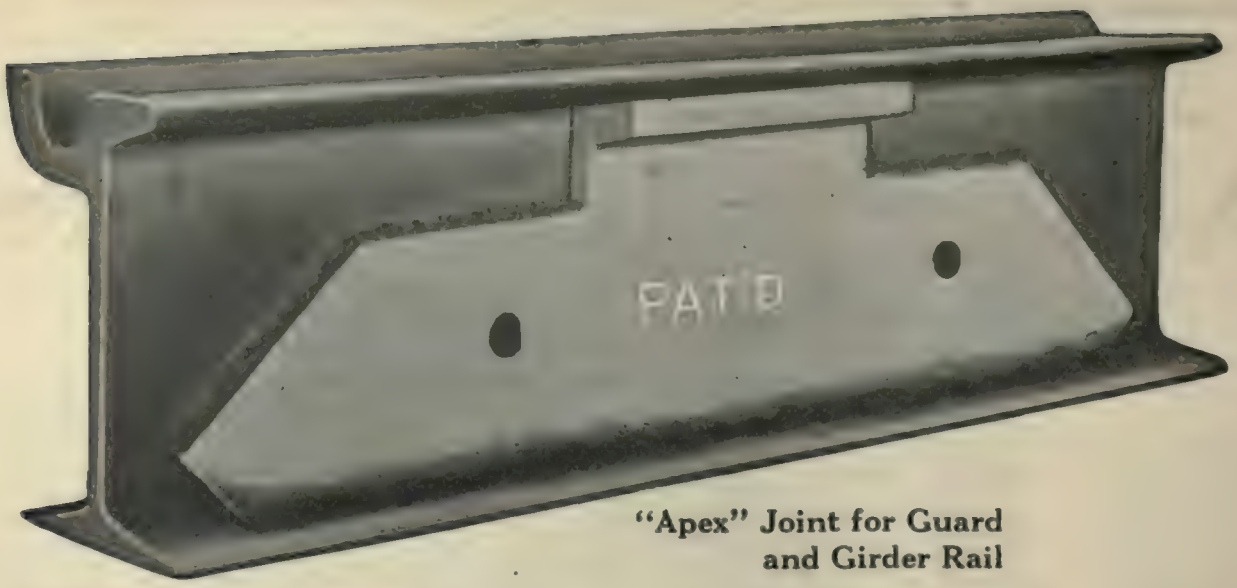
Anaconda Wire is made in sizes and in various degrees of hardness to meet every requirement.

Allow our engineers to figure on your requirements when new work is contemplated.

Photo in panel above shows Anaconda Wire Bench with annealing furnace in background



ANACONDA COPPER MINING COMPANY
Rolling Mills Dept Great Falls Mont.
General Office
Rolling Mills Dept Chicago



"Apex" Joint for Guard and Girder Rail

Start Spring Right

Make Your Track a Permanent One

by using

INDIANAPOLIS Apex Welded Joints
No Bolts-No Bonds-No Maintenance

Now is the time to begin. Build your track for the future. Your rail life is measured by its joint life. It matters not how old the rail is, Apex-Welded Joints add years to its life.

Indianapolis products are all money and maintenance savers.

Let us acquaint you with them

Indianapolis Switch & Frog Co.
Springfield, Ohio

Even on old track the installation of

Abbott Rail-Joint Plates

will pay very large returns



The photograph shows how the Lake Shore Electric Railway is using Abbott Flat-ended Rail-Joint Plates in connection with 100 lb. A. R. A. section of rail and special flat splice bars. The bars are welded to the plate and rail only along the flange of the rail, an arrangement which gives 30% of the electrical conductivity of the rail and avoids any overheating with the resulting possible injury to the rail head metal. Mr. A. V. Brown, Engineer of Construction of this road, is most enthusiastic over these joints and, believing that a device as efficient as the Abbott Rail-Joint Plate should be brought to the attention of other construction engineers, he does not hesitate to say so.



These 50-lb. rails were laid in 1908, and due to extremely heavy traffic of city and interurban cars, had developed serious joint wear by 1915. On account of the two and three-steel-car trains then being run, new track was seriously considered at that time. It was finally decided, however, to bolster up the old track with Abbott Rail-Joint Plates. This track is now standing heavier traffic than ever and will be in service for some years to come. The Abbott Plates have given entire satisfaction and since their installation there has been no trouble of any kind with the joints.

Abbott Plates laid with new rails spliced with new angle bars protect the angle bars from wearing to loose fit at the center and thereby accomplish greater maintenance economy than possible by applying the plates after the angle bars have become worn and the ends of the rails have begun to batter. The time to install Abbott Plates is therefore at the start and in this way get the longest possible life from the rails. But—the very best way to preserve old track for at least a few more years of useful life is to bring the surface up to uniform level and put Abbott Plates under all the joints.

Installation on old or relaid track is most economically and conveniently accomplished by placing the plates when the ties are respaced in the "back work" after the track laying is completed. The plates may be placed under joints in old track without disturbing the ties if adzing is resorted to, but preferably the track surface should be readjusted by working the ballast rather than by cutting into the ties.

Abbott Plates have now been used in such large quantities and for so many years that ample evidence of their worth is readily obtainable—and now that they are made in every desirable size and in types to meet every railway need, we are prepared to submit accurate data on performance and costs. If you want to know what savings they would effect on your own road, you have but to tell us your operating conditions. Our engineers will advise you to your best interests.

Ask for book
"Lackawanna Improved Track Appliances"

Lackawanna Steel Company

General Sales Offices and Works:
Lackawanna, N. Y.

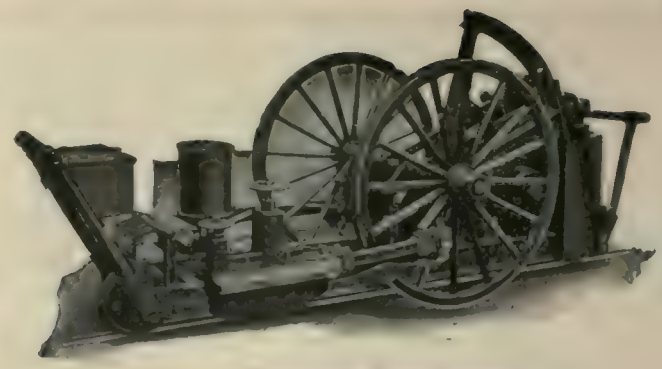
Atlanta	Cincinnati	Philadelphia
Boston	Cleveland	San Francisco
Buffalo	Detroit	St. Louis
Chicago	New York	

Licensees for the Manufacture of Lackawanna Steel Sheet Piling: For Great Britain and British Colonies in the Eastern Hemisphere: Cargo-Fleet Iron Co., Middlesbrough, England. For France, Italy, Spain, French Colonies and Protectorates, Italian Colonies and Spanish Colonies in the Eastern Hemisphere: Cie des Forges & Aciéries de la Marine et d'Homécourt, Paris, France.

Sole Exporter for Other Countries: Consolidated Steel Corporation, 165 Broadway, New York.

482

Your Choice



Reciprocating Track Grinder

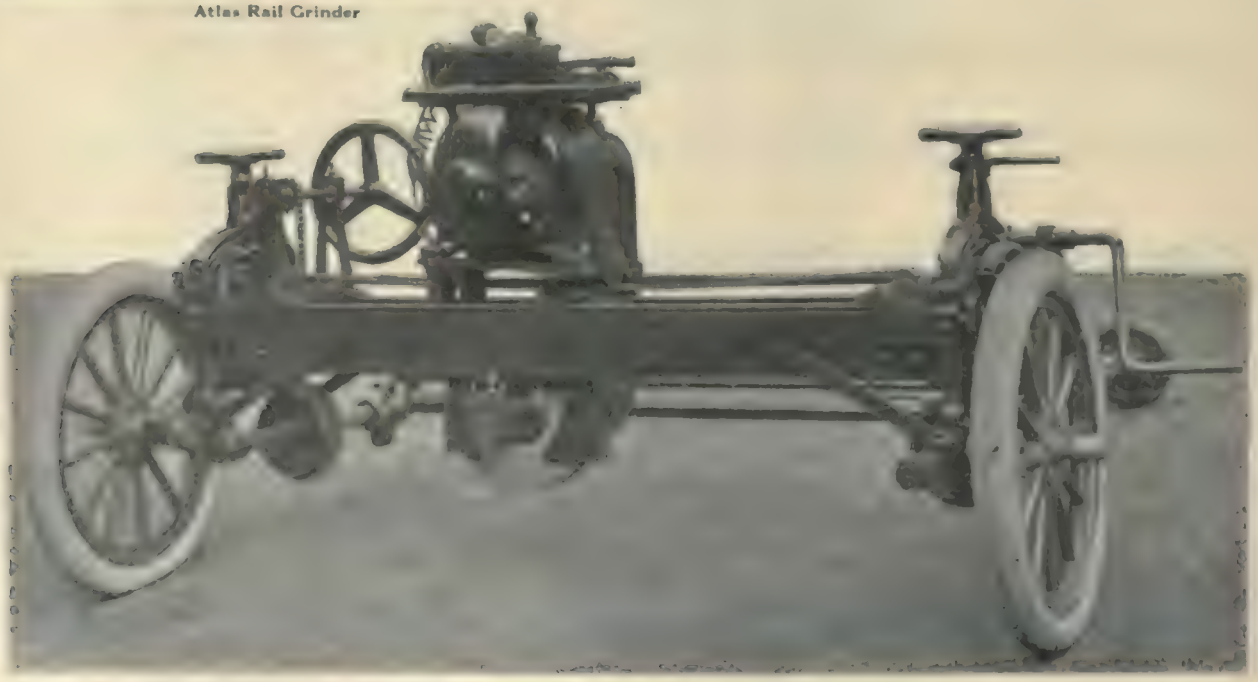
TRACK GRINDERS TO MEET EVERY SERVICE



Atlas Rail Grinder

Character or class of grinding work to be done should be considered when purchasing grinders. Let us offer suggestions.

Complete details sent on request



Universal Rotary Track Grinder

RAILWAY TRACK-WORK CO.

3132-48 East Thompson St., Philadelphia

Exclusive Agents—West

ATLAS RAILWAY SUPPLY CO.
Chicago, Ill.

ELECTRICAL ENGINEERING & MANUFACTURING CO.
Pittsburgh, Pa.

Exclusive Agents—New England

CHAS. N. WOOD CO.
Boston, Mass.

HITCHCOCK, LLOYD & CO., Inc.
77A Queen Victoria St., E. C.
London, England



National Pneumatic Door and Step Control

Means Less Delay in Congested Streets

A good deal of the lower schedule speed due to traffic congestion can't be helped; but some of it can.

For example: Higher rates of acceleration and braking as well as quicker closing and opening of doors reduce the losses due to traffic congestion, because they *save the seconds.* And seconds count when you consider that in a congested section a car is likely to stop at every block to take on or discharge passengers.

Therefore, it is necessary for both motorman and conductor to be able to take advantage of any clear space up ahead and to be able to respond *instantly* to the traffic officer's *"Go-Go".*

The use of laborless, practically instantaneous National Pneumatic Door and Step Control, including Safety Interlocking features, assures you that your men will have incentive to take advantage of every opportunity to save time because it's so easy for them to do it.

Whether you are installing National Pneumatic Door Engines alone or as a part of the famous Safety Combination of the Safety Car Devices Company, we urge that you also use the door shaft and step shaft devices of the National Pneumatic Company to secure the smoothest and most reliable operation possible with National Pneumatic Door Engines.

NATIONAL PNEUMATIC COMPANY INC.

50 Church St., New York **Edison Building, Chicago**

Works: Rahway, N. J.

GOOD ROADS!

Macadam and Telford showed how to build good roads a hundred years ago.

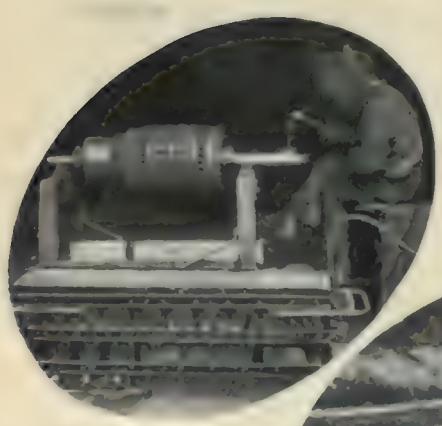
The great lesson of this generation is MAINTENANCE. Ask the soldiers about French roads, that grow new skin like your hand.

And roads of steel? Likewise

The ERICO Portable Apparatus

for Rail Bonding and Arc Welding makes an ideal maintenance system. Wherever wear or injury may appear, this small, light, portable apparatus may be operated. Its adaptability is remarkable. For instance—

THREE PHASES OF ARC WELDING



Shop Welding



Track Welding



Rail Bonding with the ERICO Portable Welder

Write us for information and prices

The Electric Railway Improvement Co.

Cleveland, Ohio

ACKLEY BRAKES
Found The World Over

The ACKLEY
No-Staff Brake
With the Double Eccentric Smooth Drum System
No Sprockets—No Chain Cutting

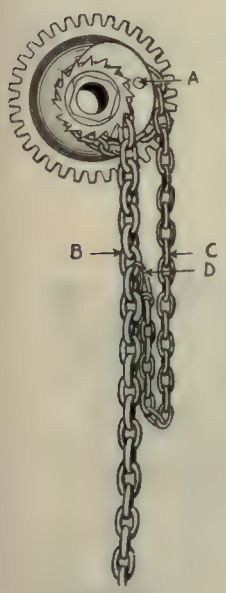


FIG. 1

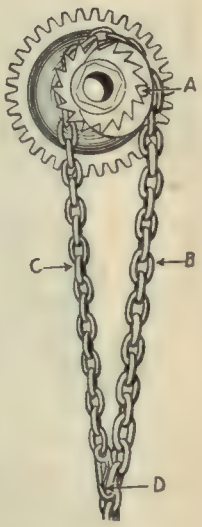


FIG. 2

Illustrating the Slack Adjustment Feature

The main chain (B) and the check chain (C) are attached by the same bolt to the drum at (A), and lie on opposite sides of the drum. The check chain is attached to the main chain by a special link (D) at a point representing the distance of the minimum backward travel of the pull rod sufficient to give the necessary brake-shoe clearance.

When brakes are being applied the main chain is taken up on one side of the drum simultaneously with the unwinding of the check chain from opposite side. Fig. 1 shows main chain wound once around drum and check chain unwound.

When brakes are being released the main chain unwinds until stopped by the mounting check chain. Fig. 2 shows main chain unwound a distance limited by the check chain (corresponding to the travel of the pull rod) so that the slightest turn of the hand wheel in the winding direction causes immediate advance of the brake shoes, all unnecessary winding having been eliminated. The special link of the check chain can be attached to any link of the main chain, so that slack can be adjusted at will.





Ask for Bulletin D

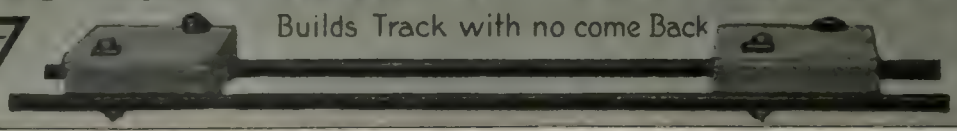
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ACKLEY BRAKE & SUPPLY CORPORATION
G S ACKLEY & COMPANY, REPRESENTATIVES
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Agencies throughout the World
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ACKLEY 2 TYPE BRAKE

The RESILIENT RAILWAY TIE

Builds Track with no come Back



How is the life of the rail prolonged by the

Resiliency

of Dayton Mechanical Ties?

The cushion feature of Resilient Railway Ties allows just the right amount of rail deflection. Always the same; in the frozen ground of Winter or the soft thawing of Springtime. This lessens rail crystallization.

The joint tie supports the rail ends from the base of the rails and on exactly the same level. Broken down joints and battered rail ends impossible.

THE DAYTON MECHANICAL TIE CO., 704 COMMERCIAL BLDG., DAYTON, OHIO

DUFF GENUINE BARRETT JACKS



Make Safety Cars Safer

A Duff Emergency Jack carried on your Safety Cars prepares you for any emergency. Many lives have been saved by having a Jack on the job at the time of the accident.

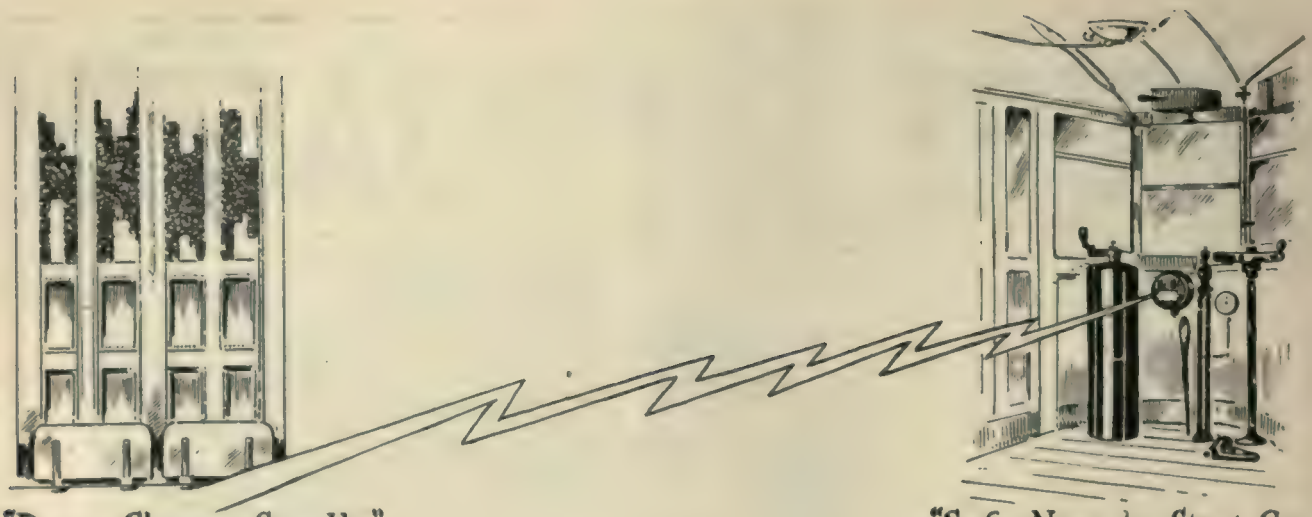
The Duff Emergency Jack has a capacity of 15 tons, and weighs only 110 lbs. It can be placed vertically or inclined up to a 15 degree angle. Will lift the full rated load on the claw.

We have issued a special bulletin showing the Duff Emergency Jack in use explaining its all-around adaptability and giving the names of many leading railways carrying a Duff Jack on every car.

Send for a copy today

THE DUFF MANUFACTURING CO.
Pittsburgh, Pa.

New York **Chicago** **Atlanta** **San Francisco**



"Doors Closed-Step Up" "Safe Now to Start Car

Your Cars Are Incomplete Without "Consolidated Motorman's" Door Light Starting Signal

Whether your cars are fitted with hand operated or air operated doors, they are incomplete from the standpoint of speed with safety, unless equipped with Consolidated Door Light Starting Signals, to give the starting signal to the motorman instantaneously with the closing of the doors.

With these signals you will accomplish two important things: you will relieve the conductor of giving a starting signal at the time when all his attention should be concentrated on the collection of fares, closing the doors and attending to the safe interchange of passengers: and you will insure the absolute elimination of accidents due to premature or unauthorized starting of the car while the doors are still open.

The cost of Consolidated Door Light Signals is so low that you can afford to put them even on the cars that you intend to put on the scrap heap next year. Just ask us for figures on this easy form of Safety Insurance.

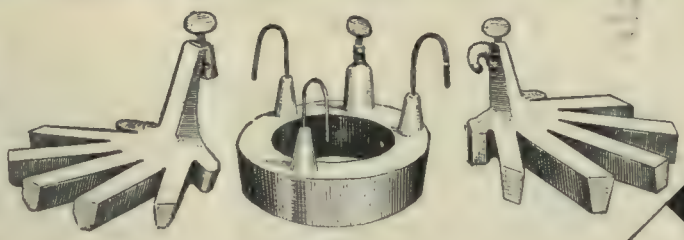
CONSOLIDATED CAR-HEATING COMPANY

ALBANY NEW YORK CHICAGO



Brady Battery Zinc

THE METAL OF QUALITY



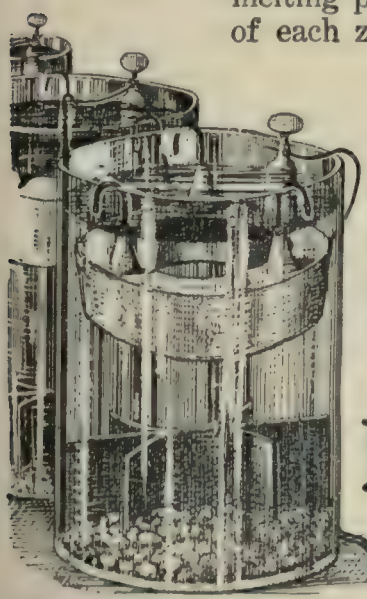
A Brady Battery Zinc works night and day for efficient operation of railway signals. It is paramount to an "efficiency expert," because it is an "efficiency producer."

In formation it is either of the crowfoot or circular pattern. In weight it is from 3 to 4 pounds. In usefulness, compared to weight and dimensions, it is huge.

A Traffic Monitor

Perfect railway signal service depends upon perfect battery service. Perfect battery service must have a perfect current, and a perfect current needs perfect battery zincs. Combine these and there will be approximately perfect traffic.

Pure virgin spelter—the best that can be bought in the metal market—analyzed in our own laboratory before used and inspected before it goes into the melting pot, is the base of each zinc.



It is a pleasure to answer all inquiries. Send us your problems.

Facilities for shipping are unexcelled. Tidewater terminals at our very door.

Pure spelter lengthens the life of the zinc, decreases internal resistance, increases battery activity, and conduces to a steady and strong flow of current. We have proved this and our customers get the benefit.

Absolute Reliability

Our one idea in producing a battery zinc is that it must not fail. From ore to finished product every process is conducted under the strictest supervision.

If mercury is requested as an alloy we use one, two or three per cent., as the order specifies. All zincs are fitted with new brass binding posts and screws.

Another Special Point

We pack our battery zincs in a special box, constructed to carry them safely whether the journey be long or short.

We have installed **Brady Battery Zincs** on the leading railway telegraph systems of the United States. The best recommendation of their efficiency is that they remain there and assume their share of responsibility in the daily operation of thousands of trains.

Brady Brass Company

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NEW YORK CITY

GENERAL OFFICES AND WORKS
170-182 Fourteenth Street
and 169-175 Fifteenth Street
JERSEY CITY, N. J.

Brady Battery Zincs Keep Business Moving



H-B LIFE GUARDS

Are the Silent Watchmen of the Safety Car

No safety car is unfailingly safe unless front end accidents are guarded against. This is why it is necessary to equip your safety cars with H-B Life Guards. They require no attention and work automatically. Their action is positive and quick as a flash.

H-B Life Guards watch out for your interests as well as those of the pedestrian. Be sure and specify them on your orders for Safety Cars.

"Barrier of Safety" between the fallen pedestrian and the car wheels.



The Consolidated Car Fender Co.
Providence, R. I.

General Sales Agent

Wendell & MacDuffie Co.
61 Broadway, New York

Measure and Save POWER

If you save power—measure the unit you save—not an indirect unit.

The ECONOMY Meter measures in "power units," not in indirect units as do other devices.

The ECONOMY Meter stimulates correct feeding and braking. Other devices put a high premium on excessively fast feeding, which does not correspondingly reduce energy consumption.

Every operating official, every motorman, every mechanic, knows that the ECONOMY Meter measures the power consumed by the car.

When using ECONOMY Meters motormen appreciate and know absolutely, trip by trip, whether or not their efforts result in actual reductions of power. With other power-saving devices motormen do not directly know whether they have actually saved power.



There is no mystery about power saving with ECONOMY Meters

The ECONOMY Meter requires *minimum* attention in its upkeep and maintenance. It does not need to be rewound at frequent intervals as do other devices.

The ECONOMY Meter is a rugged device. Over 300,000 Sangamo meters with the same type elements are in daily use where meters are needed that will withstand rough usage.

ECONOMY Meters installed on your cars will save from 10 to 20% of your total traction power. More than 50 installations and tests have demonstrated this.

ECONOMY Meters afford a correct and dependable basis on which car equipment can be inspected and maintained.

Ask for Deferred Payment Plan and estimate of operating costs

ECONOMY ELECTRIC DEVICES COMPANY

Old Colony Bldg., Chicago

National Railway Appliance Co., New York Burton R. Stare Co., Seattle Ludwig Hommel & Co., Pittsburgh
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1260 foot span in C. M. & St. Paul Electrification across the Rockies.
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WESTER
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rength

A SPAN of 1260 feet proves the strength of Western Red Cedar Poles. This span is in the line of the Chicago, Milwaukee and St. Paul electrification, 15 miles east of Butte, Montana.

The entire transmission line, across some of the highest altitudes on this continent, is supported by Western Red Cedar Poles.

The foremost pole in the accompanying illustration is 43 feet 6 inches high above the ground. In addition to insulators, cross-arms and hardware this pole carries three No. 00 six-strand, hemp core, copper cables, and 1⅜-inch Siemans-Martin seven-strand steel cable. The total weight supported is 910 pounds.

The significance of this performance can not be denied. In a region where weather hazards are greatest, Western Red Cedar Poles support the lines of a great railway system whose watchword is "service."

The faith which the Milwaukee and St. Paul Railroad has placed in Western Red Cedar Poles to render uninterrupted service proves that they possess the first of the six vital requisites for support material.

Throughout the entire line these six requisites, expressed as necessary for all poles by prominent transmission engineers, are evident in Western Red Cedar Poles.

They carry heavy loads and endure strenuous weather conditions. Their light weight affords easy handling in rough country. Their sightliness stills all agitation against overhead construction in metropolitan districts. Their low cost lessens the capital invested. Their safety and adaptability are asserted by their use in mountainous and storm-swept regions.

Butt Treatment according to W. R. C. A. specifications, will materially increase the life of Western Red Cedar Poles.

Send for information regarding Western Red Cedar Poles. See that your poles meet the six important requisites. Watch subsequent advertisements for *proof* of Western Red Cedar superiority.



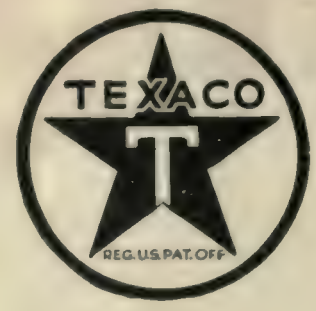
WESTERN RED CEDAR ASSOCIATION

PEYTON BUILDING

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RED CEDAR POLES

OF TRANSMISSION



TEXACO LUBRICANTS

for railway shop, power plant and rolling stock

Texaco Lubrication Engineers will gladly assist you in selecting the right Texaco Lubricants for your shop—power-plant rolling stock, or any other equipment.

You may call upon them to make a survey of the equipment if necessary. This is Texaco Service—there is no charge.

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MONROE

Reg. U. S. Pat. Office

Calculating Machine



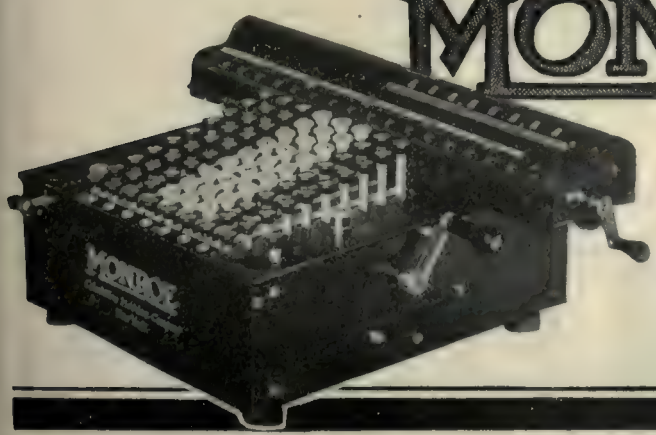
"Letting the Monroe Calculating Machine Prove Its Own Case"

"THIS machine will take care of all the figuring of every department in your organization for the Monroe not only Adds, but Multiplies, Divides and Subtracts as easily as other machines Add.

"The operation of the Monroe is so simple and direct that anyone can work out complicated calculations after a few minutes' practice. For instance, just depress the keys. Then turn the crank—Forward to Add or Multiply, backward to Subtract or Divide. Nothing could be easier or simple.

"And here's another big advantage—the Monroe Visible Check. The figures are always in sight of the operator who is able, at all times, to verify every calculation at a glance. Because of these the Monroe is daily proving in thousands of offices that it has no superior in speed and *absolute* accuracy on all kinds of figuring.

"Better than anything we may say for the Monroe is an actual try-out of the machine on your work in your own offices by your own help. You can then be the judge as to whether the time, money, and errors the Monroe will save you will justify its installation. No obligation whatever."



MONROE

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Calculating Machine

Not only Adds, but Multiplies, Divides and Subtracts as easily as other machines Add.

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The "SHOW ME" coupon—Mail it today

To Monroe Calculating Machine Company,
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White 2-ton tower truck, owned by Worcester Consolidated Street Railway Co., Worcester, Mass.

PERFORMING EFFICIENTLY AFTER FIVE YEARS OF SERVICE

THE Worcester Consolidated Street Railway Co., of Worcester, Mass., has operated a White 2-ton tower truck since December, 1914. It is used for making emergency repairs on the overhead construction and transmission lines.

The ability of this White to respond quickly to emergency calls at all times has helped to maintain street railway schedules. "We find it a very efficient and dependable truck," says Mr. W. L. Harwood, Electrical Engineer.

There are more White Trucks in the service of Public Utilities—Electric Railways, Telephone, Gas and Electric Companies—than trucks of any other make. Whites predominate mainly because their dependability and economy have been so firmly established. White Trucks are everywhere known for their high earning power, for their ability to do *the most work for the least money.*

THE WHITE COMPANY
CLEVELAND

White Trucks

Along the Road of Progress
50 Years of Galena Service



Back in 1869 Galena Service first came on the market. It was then a marked improvement over all others. Horse cars were then in vogue and Electric Cars were unheard of. Just see what progress has been made in that short stretch of 50 years.

Rapid strides have been made in all lines but not too rapid for the Galena Service. As new devices and new inventions were made it meant the improving of Galena Service to compare with conditions. Not only has it met each condition that has arisen but has kept a step or two in advance.

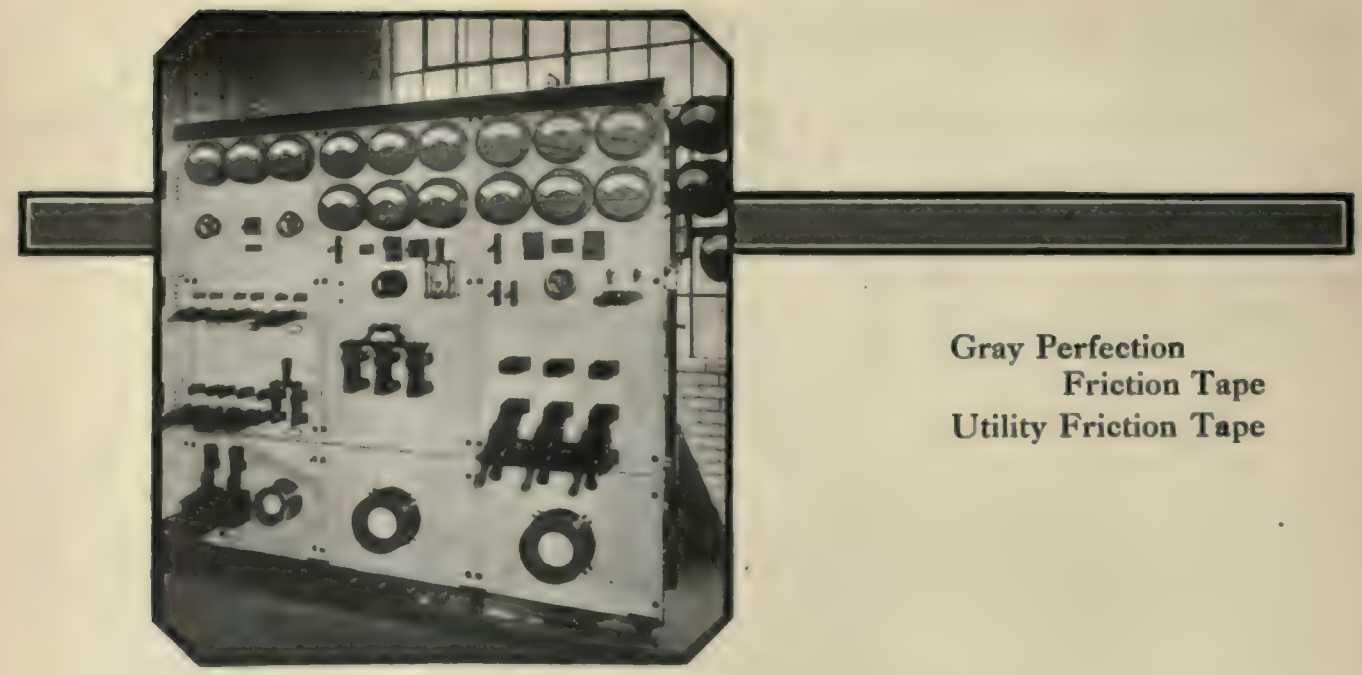
Today as in 1869 Galena Service is an established fact and when real service is demanded Electric Railways always know where to turn. So well is our policy established and so fair have we been with our prices that the majority of the Electric Railways have adopted the Galena Service as a standard.

Galena-Signal Oil Company

New York *Franklin, Pa.* *Chicago*

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Gray Perfection
Friction Tape
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Uniform Tape Quality

The uniform good quality of United States Friction Tapes and Splicing Compounds is due to high grade raw materials, ample manufacturing facilities, and rigid inspection.

United States Rubber Company

The World's Largest and Most Experienced Manufacturer of Mechanical Rubber Goods.





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YEARS of manufacturing a successful tape for every trade and purpose place the United States Rubber Company in a position to meet every need of electrical engineers and manufacturers.

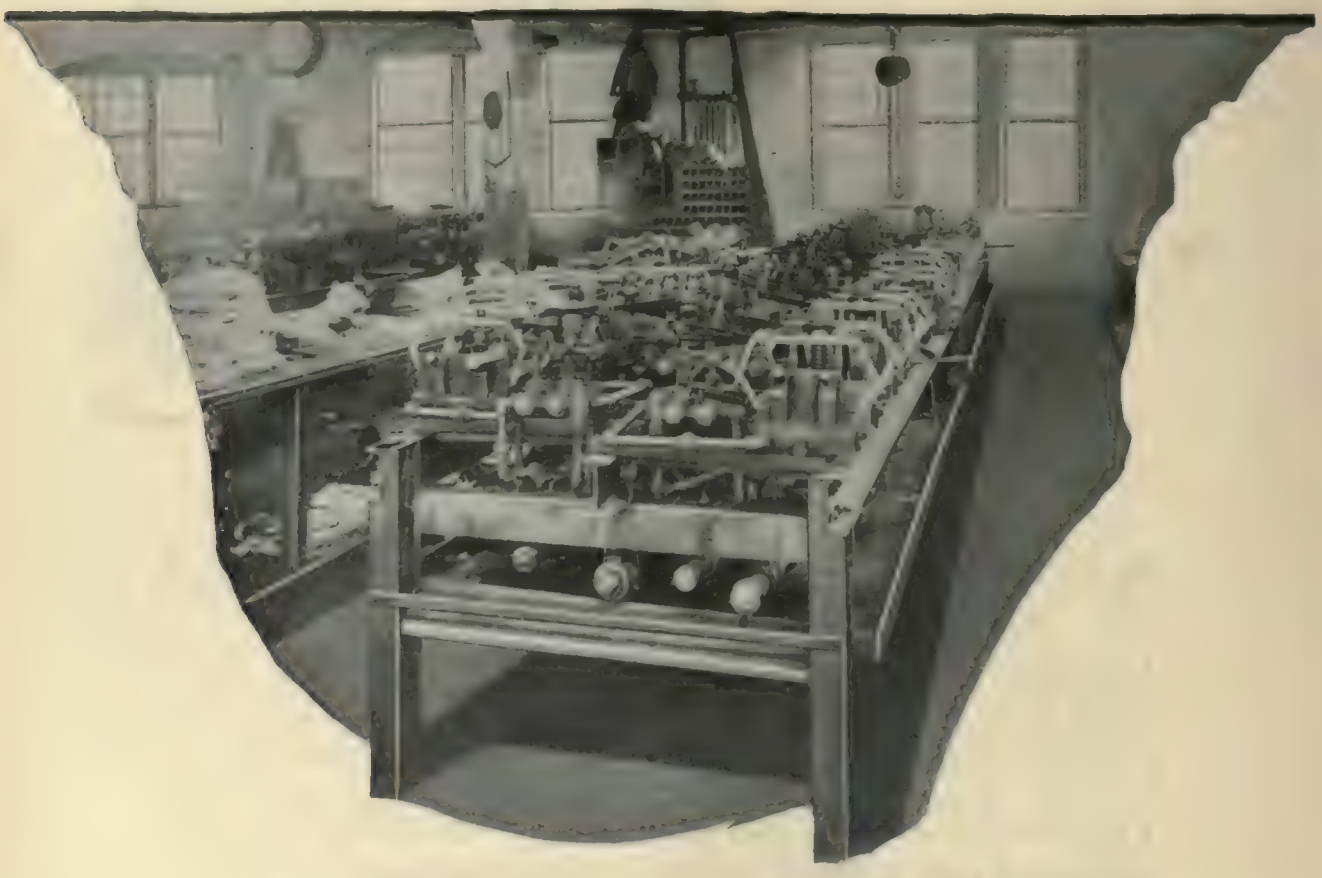
The co-operation of this company's representatives is freely offered to tape users desiring to obtain the greatest value from their annual investment in tape. The distribution of tape in our many Branches insures adequate and prompt delivery service.

United States Rubber Company

The World's Largest and Most Experienced Manufacturer of Mechanical Rubber Goods.

UNITED STATES RUBBER COMPANY
US
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AND ASSOCIATED COMPANIES

If repairs or replacements on apparatus are made with parts supplied by the manufacturer, original equipment quality is maintained.



Fair Play for Your Motors

A G-E coil will fit the armature slots of a G-E motor as no other coil will.

This means a perfect fit without jamming or forcing; a coil that is neither too large nor too small. A coil which is too large will be injured while being installed, and one too small will vibrate, chafe and ultimately ground while in service.

G-E Armature Coils

are made from first to last with quality material and workmanship. They fit G-E motors perfectly and consequently are the easiest to install.

G-E coils are steam moulded, a process which increases their life by at least 25 per cent.

Be consistent. The best of motors warrants using the best of coils.

General Electric Company

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Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Volume 55 New York, Saturday, April 3, 1920 *Number* 14

Cincinnati Explains the Difference

IN THE issue of March 20 we commented on the excellent report on the street railway situation made in Kansas City. This week we print a digest of a Cincinnati report analyzing the reason for fare difference in Cincinnati and Cleveland. It is another piece of evidence of the rapidly growing appreciation of the electric railway business. The report shows a comprehension of some of the costs of furnishing local transportation.

But, more than this, it is another example of what happens when two parties who have different conceptions get acquainted with each other's views and problems. We have consistently encouraged such efforts on the part of both company and public and believe these efforts should never be allowed to lag. The final result is sure to be an appreciation on the part of the public of many of the problems of transportation and also a growing confidence in the managers and operators of transportation properties.

Novel Features Introduced in a "Service-at-Cost" Plan

THE idea of cost of service as a basis for the conditions under which city transportation is to be supplied is extending. The latest city to adopt the plan is Memphis. In the method of its adoption, however, the Memphis case is unique, at least so far as we now recall. In that city the plan was not the result of a bargain between the company and the city, but it became an order through the new Public Service Commission of Tennessee. It has been accepted, however, by both company and city.

The origin and the authority under which the plan was promulgated, however, are not the only novel features of the Memphis agreement. One departure from previous practice is that the agreement provides for two reserve funds, each with critical upper and lower limits and independent of each other, one for a depreciation fund and the other for determining fares. The latter, as usual, is the surplus after all the charges of every kind are paid, while the former is a variable percentage of the value of the depreciable property of the company, the variation in percentage depending upon the amount of money in the fund. Incidentally, there are some other novel features, such as the use for a service index of car-miles per passenger instead of its reciprocal and the establishment of a maximum service limit, that is to say, a minimum number of passengers per car-mile. The latter we regard as a salutary sign of the growing interest of cities and the public in general in limiting the expenses of the companies. The provision of procedure to follow in the case of emergencies is a rather wise planning for the future.

It is only reasonable to expect that there will be progress in franchise making, as in other branches of human endeavor. The service-at-cost franchise is one of the youngest forms of agreements for railway operation and evolution in it is to be expected. The Public Service Commission of Tennessee has helped the industry by its contributions toward this development.

What Electric Railroading Is Like Under Arctic Conditions

NO PLAN has yet been formulated to build an electric line over the route from northern Greenland to the North Pole followed by the late Admiral Peary. Nevertheless, if such a line should be built there are many managers in this country who feel that so far as experience with fighting snow is concerned, based on the experience of the past winter, they would be fully qualified to operate such a line. Evidence from every side is that the past three months have been the worst as regards snow ever experienced, at least in the northeastern part of the country.

January was unusually severe on electric operation, but it remained for the next two months to cap the climax. The storm of Feb. 5 was so heavy that many of the routes had actually to be abandoned, and some of them had not been dug out when the storm of March 6 put things in as bad condition as they were before, or worse. There are still parts of New England, or were last week, where there are cars on the road in the position in which they were stalled on Feb. 5. Even in New York City traffic was stopped because of the weather on at least one of the longitudinal lines for about the same length of time as on the interurban stretches. The sections thus blocked have been, it is true, lines of normally light traffic, and the energies of the operating companies have naturally been devoted first to clearing the heavily traveled routes, but the fact that traffic had to be suspended on them for more than seven weeks shows the severity of the climatic conditions.

The trouble seems not to have been due entirely to the quantity of snow which fell during the two major snowstorms in the period in question, but to the nature of the precipitation. This consisted in many areas in part of fine hail, which, combined with partially melted snow, coated the tracks with ice. This made necessary the use of picks as well as shovels. Another factor more important than ever before to delay electric railway traffic was the increased number of automobiles, particularly of motor trucks. These not only kept on the tracks, because the tracks were the only parts of the highways which were cleared, and thus impeded the

car movements, but with their heavy loads they packed the snow down again on the rails and made not one but many clearings of the tracks by the railway companies necessary.

There is no doubt that the large increase in the number of motor vehicles during the last few years makes necessary some change in the plan by which our highways, both in cities and between cities, are kept free from snow in winter. Heretofore, this burden has been thrown almost entirely on the electric railway companies. They have removed snow from their tracks, and as other streets have not been touched all traffic has naturally used the narrow strip cleared by the railway company. This condition prevails not only in the city but also in the country where electric tracks are built along the highway. Even where the space between the rails is at one side of the highway and not paved the motor vehicles will use the tracks, because the snow soon becomes packed there to the height of the rails and the rest of the road is impassable.

To lessen the delays which have been caused by the use of his single-track line in this way by motor vehicles last winter one ingenious railway manager organized a sort of dispatching system between his cars for these trucks. He dug out turnouts for the trucks at intervals along the line and then sent his cars through in batches. Otherwise, there would have been endless confusion and congestion. It was not done primarily as an act of civic betterment, but purely to permit his own cars to use his own tracks after they had been dug out by his own men.

But this was not the only gratuitous work that he had to do to keep his tracks clear for his own cars. On account of the severity of the weather individual motor trucks would frequently break down, and as they always broke down on the track, because that was the only clear part of the highway, they had to be lifted off by railway employees. Again, motor vehicles which used the track at night, when there were no railway employees to help, and were broken down or became stalled from the snow would frequently be found in the morning abandoned and blocking the track. Even the movement at night of motor trucks which did not break down and did not require dispatching was a source of considerable expense to the company. This was because they would pack down hard on the track and roadway any snow which fell in the night or drifted over onto the tracks, with the result that railway traffic in the morning could be resumed only if the solidified ice and snow left by the motor trucks was removed by the renewed use of pick and scraper by the railway company. The experience of one manager has been cited not as an isolated instance, but because it is typical of many roads in New England similarly situated.

Something must be done to remedy this state of affairs. We believe that every one will admit that it is not the duty of the railway companies to act in the winter as a servant without pay to every user of the highway, providing the only route by which they can travel and helping them out if they break down, at least to the extent of getting them off the track. The question has not been a critical one before because the number of motor vehicles has not been large, nor have they constituted so large a percentage of the total number of users of the highway. The farmer's sleigh would use the portion of the road intended for general vehicles, but if the number of vehicles on wheels is now so large in winter as to require cleared roads they should be provided by the county or city. Otherwise, the railway companies may well consider making no attempt to keep in operation after a heavy snowstorm those sections of their tracks which have only a light traffic.

Snow and Water Keep the Motor Maintainer Awake at Night

THE recent terrible weather has brought up questions other than that of whose duty it is to remove snow and ice from the highways for the use of vehicles other than the electric cars. One of these questions is as to what is the most efficient form of snow-fighting equipment. Another is whether there is any way of making motors so that they will be less adversely affected by such weather as we experienced during the past few months.

Undoubtedly the conditions have been most unfavorable for electrical apparatus. Motors with ample capacity to operate cars on a dry, clean rail become overloaded unless very large when the cars have to be forced over a rail covered with snow and with the grooves often filled with ice. Where the wheels slip motormen will leave the current on for a long period, hoping that the wheels will bite. Water will find its way into the casing and snow and small particles of ice will be drawn in through the ventilating ducts. If brine from the salt used to melt the snow at switch points gets into the motor it will hasten deterioration.

Alternate baking from overload and wetting will affect the windings of any motor. In spite of these difficulties some means must be found for preventing motors from failing even under the arduous conditions presented by winter service. It will not do to consider the motor only as a "fair weather" machine. This is a matter which should be taken up most seriously by the electrical companies.

"In the City Hall" a Continuous Performance

"NIGHTIE NIGHT" is a play that sounds naughty but turns out nice. It is a legitimate farce with a thousand laughs. One pays a speculator $3 for a ticket and feels well repaid. In New York, however, there is a greater farce than "Nightie Night" or even "Up in Mabel's Room." It is the uproariously funny "In the City Hall." The principal actors are all politicians. The direct admission price is nothing. There will be an ultimate price, however, but that is another story. In "In the City Hall" the unwilling villain recently withdrew. The going got too rough for him. He had been heckled enough. The late Richard Mansfield was a rough leading man, but he was gentle compared with leading man Hylan and his understudies in the great traction drama. But the *dramatis personnae* of "In the City Hall" announce that the show will go on without the villain.

Of course it will. Jesters are jesters. But let us return to the stage. The Interborough villain was arraigned by the city for not saving enough. The New York Railways villain was arraigned for saving too much. Buses were put on Staten Island by the city to replace the trolleys that were withdrawn. Now the city wants to buy electric cars, seize the Midland Railway and run the road itself.

In Manhattan, however, more than a million dollars is appropriated by the city to purchase buses to replace street cars. In the midst of the play New York's Mayor, all worn out shoveling snow, went to Palm Beach, leaving the sun and the rain to do away with the snow that he hadn't removed. Nature's slow process has succeeded where human nature failed. And yet Barnum & Bailey have come to New York with their clowns. As if there were not enough high-paid circus talent in New York already!

Of Course Shoe Prices Are Higher

THE Allied Council of the Shoe and Leather Industry and Trades (a name to conjure with!) is reported to have decided upon a campaign of publicity. Its purpose is not primarily to increase the consumption of shoes, but to explain why shoes cost more than they did. And this is a perfectly straightforward proposition, because the shoe industry wants satisfied patrons. Of course the shoe men are not pleading for permission to charge a higher price, they do that anyway; but they want shoe users, which category takes in everybody, to wear their footgear contentedly, feeling that they have had a "good buy."

How similar is the case of the shoe men to that of the electric railway operators, and yet how different! Car rides cost more than they did, just like shoes. But the ride makers and vendors cannot put up their prices and then tell the public, "It's too bad, but it must be done." No, the public somehow has a different standard for utility service and shoe service. In fact, the shoe purchaser says almost with pride: "I paid $16 for those shoes; some price, eh?" And as for luxuries, the people are throwing money away like water. They seem to enjoy paying high prices. But who ever heard of a car patron hankering for a higher fare?

All of this is so obvious to the railway operator that it seems as if the dullest member of the body politic ought to see it. But he doesn't, or possibly he will not. Hence there is on each railway manager a burden, not only of giving the best service possible under his circumstances, but of convincing the public, often against its will, that if diamonds, shoes and toothpicks legitimately cost more, as they do, then it must be willing to pay a small part of the enormously increased contents of its pay envelope for being transported safely, reasonably, quickly and, in general, comfortably from place to place by means of the electric car.

The Water Bug and His Monomania

THE water bug is a creature who is obsessed with the monomania that if he could run electric railway securities through a clothes-wringer the electric railway's fare would shrink in the same ratio as the dehydrated securities. Without entering into any of the "reproduction cost new" or other valuation theories of the day, we venture to affirm that in most cases the amount of water squirted out from the wringer rolls would be much less than the water bug expected. In fact, we had a specific case called to our attention recently where the "rentals and interest" item proved amazingly small despite the fact that the property in question is not exactly as dry as the United States at large. "Rentals and interest" were actually less than 10 per cent of all expenditures. Hence if this railway had no overhead at all, the fare could not possibly be cut more than ½ cent if figured from a 5-cent basis. It would have astonished the water bug to find that "taxes," if abolished entirely, would have permitted practically the same reduction! But, of course, the water bug does not believe in the elimination of taxes, even if he does dream that people will lend money to a concern which cannot guarantee either the payment of interest or the return of principal.

The real reason for the insufficiency of the 5-cent fare lay exactly where the railway had asserted it did, namely, in the higher cost of labor, materials and fuel. Thus the increase alone of platform wages was in itself equal to entire fixed charges and taxes together. If electric railway managers would but stress points like this more often there would be less backbiting by the water bugs. It is proper enough to insist that fictitious values should be squeezed out, but the public ought to and can be made to understand that on most electric railways "rentals and interest" is not of primary or even of secondary importance in the allocation of the fare to the several channels of expenditure.

Steam Railroad Electrification Must Be Considered More Broadly

SO far the transportation interests of the country have merely dabbled in the subject of steam railroad electrification. Probably this is natural and logical, but the time is now here when the situation must be changed. In the past attention has been focussed more on the technical than the economic phases of the subject. This is certainly not to be deplored, as it is the normal and proper order first to develop a new system to a reasonable degree of perfection, then to fit it into its proper place in the industrial machine. It would have been foolish to spend a lot of money in equipping a railroad for electrical operation before the locomotives and power supply had emerged from the experimental stage. They have done so now, however, and attention may well be turned toward the next stage, that of application to the transportation needs of the country.

A glance at the pages of transportation papers here and abroad will show the change which is now going on in the minds of the leaders of thought in this field. There are at least two salient features here. One is the necessity for fuel conservation, a conspicuous factor in European electrification plans. The other is the urgency of complete rehabilitation of the steam roads, involving vast sums, running into the billions of dollars. Now if electrification is coming, and all thoughtful transportation men seem to feel that it is, it is vital to bring in a logical electrification program in connection with the coming great expenditures. We realize that the money for all of this work is not in sight and that 1920 budgets are being pruned to the limit. But the country's life depends upon good transportation. The H. C. L. will come down when the character of our transportation in all of its various phases goes up.

We must have good railroads, fine railroads, and what we must have we can have; maybe not in 1920, but progress will not stop with 1920. We may have to think in decades, rather than years, but whatever the unit of time in which we think, the unit of investment cost in railroads must be the billion.

Norfolk Invites the Public Utility Investor

**This Virginia City Announces a "Service-at-a-Profit" Policy—
State Corporation Commission Encourages This Attitude**

A POLICY of actual encouragement and invitation to public utility investors is now the official corporate platform of Norfolk, Va. We believe this to be the first case in which a municipality by corporate action, in this instance unanimous, has *guaranteed* both capital and cumulative return at an inviting rate on that capital invested in public utilities within its limits. It is perhaps the most striking example of the changing attitude of the public toward public utility enterprises and may prove a leading case in the future treatment of public utilities by governmental agencies. In effect, the city recognizes not only the right but the necessity of a public utility earning a fair profit.

The present case has to do with the City Gas Company of Norfolk, one of the subsidiaries of the Virginia Railway & Power Company, but this is merely the first of a series, for there are rearrangements of railway and light and power relations to follow. A policy had to be determined at the start. The city, therefore, when advised by the company that an increase in gas rates would be requested through the State Corporation Commission, set out to determine its own attitude in the matter. Norfolk acts in public utility matters on the advice of its Public Utilities Commission, an advisory body of leading citizens, which reports to the council of five. The commission and council engaged A. Merritt Taylor, former Transit Commissioner of Philadelphia and manager of the Division of Transportation and Housing of the Emergency Fleet Corporation during the war.

A valuation and report were made by Mr. Taylor and his associate, Charles B. Cooke, Jr., some details of which were noted in the ELECTRIC RAILWAY JOURNAL of March 27. A principle announced in this report was unanimously adopted by the Public Utilities Commission and also by the City Council as a sort of city platform toward utilities. Personal interviews with the chairman of the commission, the city attorney and others indicate that the city means what it says. The authorities have gone into the matter with their eyes open and with a full appreciation that the public utility is a business responsive to the same fluctuations and limitations as other businesses.

As corollary to the platform the city states further its belief:

"Municipalities which ignore this cardinal principle are not entitled to the confidence of those who have capital to invest and will be shunned by them.

"Municipalities which adopt and adhere to this cardinal principle will be sought out as safe places to which capital will become readily available for the up-building of public utilities and other constructive enterprises."

The city and company met on this platform and agreed on a valuation and a rate. The understanding was not one-sided, for there was disagreement as to valuation, as well as criticism as to service and as to quality of gas, points on which the company recognized its duty and so made concessions in valuation and arrangements to restore 100 per cent service condition. The company felt assured that the city's attitude would make possible the obtaining of necessary funds for extending and improving the service. The city authorized its representatives and Mr. Taylor to urge its program before the State Corporation Commission at the hearing.

When the case came before the State commission on Monday of this week Virginia's attitude as a state was shown to have that same broad-gage business policy reflected by the city of Norfolk. There was no trial, or even a presentation of testimony in the usual sense. The commission, while reserving the right to check the figures in detail, took the business-like attitude that if the city authorities, the city's expert and the company agreed on a working basis, on a platform approved by the commission and on a rate for gas, the agreement was probably fair and the new rate would be approved. Commissioner William A. Rhea, chairman, repeated the commission's policy that "Unless public utilities get some relief, Virginia will either lose its utilities or get poor service. . . . The present instance presents a *prima facie* case and it appears the commission's duty to approve this agreement." There were a few objections from irate citizens who didn't want to pay $1.60 per thousand cubic feet for gas, but even they expressed a desire to deal fairly with the company and merely questioned the accuracy of figures.

The general impression, after a study of the situation on the ground, is that the city of Norfolk and the State of Virginia desire to encourage utility growth. They believe that public utilities are necessary and as businesses are amenable to the same laws as other businesses. They realize that successful public utilities encourage not only healthy growth in the utilities themselves but also the development of other enterprises in the community. They believe that the "service-at-a-fair-profit" policy they have adopted will assist in the material and social advancement of the whole state.

Norfolk Public Utility Platform

"Capital legitimately invested in public utility properties must be safeguarded and protected by municipalities, both as to principal and as to a just and inviting return thereon after reimbursement to the company for expenses incurred in providing service."

The Place of the Bus—II

Details Are Presented of the Relative Costs of Car and Bus Operation in Great Britain, Together With Some Notes on Bus Design, Weight and Capacity — Operating Speeds, Legal Regulations, Fuel and Roadway Taxes Are Also Considered

BY WALTER JACKSON
Consulting Engineer

ALTHOUGH British unit costs are different from our own, there is much that can be learned by studying comparisons of car and bus operations in Great Britain, particularly where the figures relate to the respective operations in the same community and under the same management. These figures will show that wherever the services are co-ordinated instead of competitive the number of passengers per vehicle-mile is usually much less on the bus than on the car, clearly indicating that the buses are being used for light-traffic routes. Furthermore, the earnings per bus-mile and the receipts per passenger are generally in excess of like classifications on the electric railway because the average ride on the bus is longer and the rate of fare on the bus is higher. The schedule speeds of the buses are almost always higher than those of the cars, not on account of superior flexibility or higher maximum speeds but because the buses average fewer stops per mile and have a much larger proportion of their runs in suburban territory or open country.



LONDON'S NEW DOUBLE-DECK FORTY-SIX-SEATER, WHICH WEIGHS ONLY 170 LB. PER SEAT

Facts like the foregoing can be readily deduced by a study of the accompanying Table I, which has been prepared from the private records of a number of British tramways conducting bus services. In this table there have been included the bus figures for both 1917 and 1918, whereas the car figures were available only for 1917. It will be understood, of course, that the operating expenses of the cars have also gone up during 1918, as will be seen from the following data, but not in the same proportion as for the buses. The reason that favors the car is its larger capacity, which makes the predominant increase, wages, less troublesome than with the smaller bus. On the other hand, the bus is not held down by statute to fixed maximum rates of fare and therefore has been more successful in getting more revenue per passenger carried. As the average length of ride is also greater on the buses, there is less tendency to lose traffic because of any increase in fares.

Table I shows that on System "E" the passengers per vehicle-mile for 1917 ran as low as 2.6 per bus-mile compared with 9.3 per car-mile, and as high as 6.6 per bus-mile compared with 11 per car-mile on System "H." System "C," enjoying the extraordinary traffic of 19.4 passengers per car-mile, did not do better than 3.3 passengers per bus-mile. These figures clearly indicate that the buses are confined to lines of what the British consider extremely light traffic, or to routes of seasonal or pleasure traffic. System "C" has been running buses for nearly fifteen years, System "E" for nearly seven years and System "H" for six years, so it may be assumed that these companies have had enough experience to determine the correct field of the motor bus.

TABLE I—COMPARATIVE EARNINGS, EARNINGS PER PASSENGER, EXPENSES, PASSENGERS PER VEHICLE MILE AND SPEEDS OF CARS AND BUSES RUN IN THE SAME DISTRICT UNDER THE SAME MANAGEMENT. BUS AND CAR FIGURES FOR 1917, ALSO BUS FIGURES FOR 1918

Community	A Cents	B Cents	C Cents	D Cents	E Cents	F Cents	G Cents	H Cents
Earnings per car-mile 1917.	31 4	31.0	36.9	32.8	22.11	28.5	27.9	31.3
Earnings per bus-mile 1917	47 0	46.9	38.3	43.0	34.6	36.7	36.4	34.8
Earnings per bus-mile 1918	60 6	50.8	45.4	52.9	43.6	43.7	45.8	41.2
Earnings per car-pass. 1917	2.54	1.92	1.10	2.46	2.38	2.38	2.54	2.38
Earn. per bus-pass. 1917....	10 04	11 04	11.24	13 82	12.24	8 48	10 34	5 28
Earn per bus-pass. 1918....	11.58	12 18	11 72	16.16	13 04	9.20	12 34	5 60
Earnings per car-hour 1917	$1 88	$2.34	$2.67	$1.41	$1.36	$1.80	$1.80	$2.16
Earnings per bus-hour 1917	3 85	4 04	3.34	2.89	3 94	2.61	3.34	2 81
Earnings per bus-hour 1918	4.20	4.18	3.79	3.51	4.49	3.12	4.01	3.36
Expenses per car-mile 1917	20.2	24.0	20.9	17.8	13.2	17.4	17.1	14.9
Expenses per bus-mile 1917	26.2	27.1	31.4	27.5	24.5	25.6	29.4	28.9
Expenses per bus-mile 1918	34 1	32.3	31 3	37.1	28.7	32.1	39.1	33.6
Exp. per car-hour 1917	$1 21	$1 81	$1 51	$1.08	$0 82	$1.10	$1 11	$1 06
Expenses per bus-hour 1917	2 16	2.33	2.74	1 86	2 09	1.82	2.61	2.33
Expenses per bus-hour 1918	2.98	2.63	2.61	2.46	2.96	2.32	3.43	2.73
Miles per car-hour 1917.	6 0	7 5	7 2	6 1	6 2	6.3	6.5	7.1
Miles per bus-hour 1917	8.2	8.6	8 7	6.7	8.5	7.1	8.9	6.6
Miles per bus-hour 1918...	8.1	8.2	8.3	6.6	10.3	7.2	8.8	7.3
Pass. per car-mile 1917	12.3	16 0	19 4	9.4	9.3	11.8	10.8	11.0
Pass. per bus-mile 1917..	4.6	4.2	3.3	3.1	2.6	4.2	3.6	6.6
Pass. per bus-mile 1918 ...	5 2	4.1	3 7	3 2	3.0	4.6	3.3	7.3

That the fares are higher and the average length of ride longer on the buses is shown by their universally higher intake per vehicle-mile and per passenger. In 1917 System "A" showed 47 cents per bus-mile against 31.4 cents per car-mile, although the cars had 12.3 passengers and the buses only 4.6 passengers per car-mile. Hence the earnings per passenger were more than 10 cents on the bus against only 2.54 cents on the car. Similar conditions prevail on the other systems. The schedule speeds of the motor-buses varied



SINGLE-DECK BUS FOR WALSALL CORPORATION TRAMWAYS

from 6.6 to 8.9 m.p.h. as compared with 7.1 to 7.5 m.p.h. on the larger cars in heavier service.

Table I also shows that the operating expenses per vehicle-mile are invariably higher with the bus even without due allowance to the car for its larger capacity. Against 13.2 cents per car-mile on System "E" we have a bus cost of 24.5 cents (28.7 cents in 1918); against 17.8 cents per car-mile on System "D" we have 27.5 cents per bus-mile (31.1 cents in 1918), etc. It will be understood that in both cases only actual operating expenses are presented. Taxes, depreciation and overhead charges are not included. The operating expenses charged against the car include power, distribution, track, line and buildings.

COMPARATIVE COSTS ON MUNICIPAL TRAMWAYS

The Manchester Corporation Tramways has been running buses since 1914. The relative development of the bus service in this city of 950,000 is expressed by the following comparative data for the fiscal year ended March 31, 1919:[1]

Passengers carried on cars	253,940,203
Passengers carried on buses	1,821,310
Car-miles run	18,146,551
Bus-miles run	218,292
Revenue per car-mile	36.2 cents
Revenue per bus-mile	29.8 cents
Operating expenses per car-mile	25.5 cents
Operating expenses per bus-mile	23.2 cents

The foregoing comparisons are not absolutely exact because the last annual report gives the over-all statistics with buses included, aside from the separate bus tabulation. However, the bus is so small a part of the whole that it is hardly necessary to make corrections for the same. The operating expenses per bus-mile are in this case less than for the cars, but the cost per bus-seat furnished is undoubtedly much higher, judging from the fact that Manchester operates double-deck, double-truck cars. As 218,292 bus-miles were

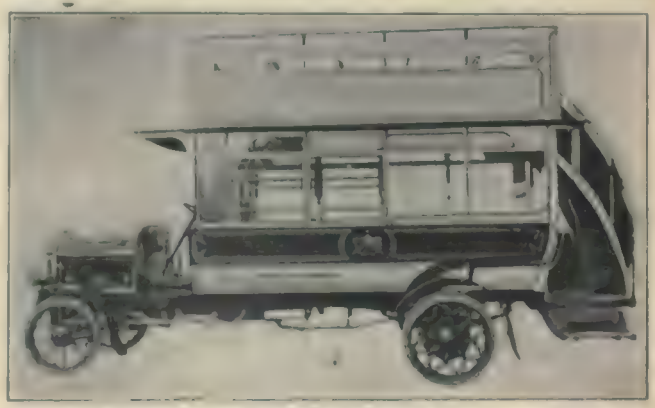
[1] In this and all other tables in this article 2 cents have been taken as being the equivalent of 1 penny.

TABLE II—OPERATING COSTS PER MILE OF MOTOR BUSES OF MANCHESTER CORPORATION TRAMWAYS

Traffic expenses:	
Superintendence and other traffic wages	0.2d.
Wages of drivers and guards	2.507
Bonuses and sick pay	0.040
Cleaning and oiling	0.719
Depot expenses	0.192
Ticket check	0.285
Uniforms (furnished free)	0.113
Licenses and sundries	0.065
General expenses:	
Salaries and wages—administration	0.138
Taxes on depots	0.088
Printing and stationery	0.023
Fuel, light and water	0.022
Compensation	0.055
Insurance	0.044
Repairs and maintenance:	
Tires	0.530
Chassis	1.500
Bodies	0.255
Buildings and machinery	0.060
Power—petrol	4.801
Total operating expense	11.637 d.
Depreciation	1.376 d.
War bonuses	1.674 d.
Balance	0.231 d.
Total income	14.918 d. or 7.5 cents

required for 1,821,310 passengers, the passengers per bus-mile equal 8.3 while the revenue per passenger is 3.6 cents. The passengers per car-mile during the same period equal 13.9 while the revenue per passenger is 2.6 cents. The present Manchester bus routes are extensions from the Palatine Road tramway terminus to Northenden, Cheadle and West Point. The headways are thirty and sixty minutes. Table II is a detailed statement of the cost of Manchester motor-bus operation for the year ended March 31, 1919. It will be noted that, because of the present abnormal price of automobile fuel, the cost of petrol is even higher than wages.

Without question, the paper on motor-bus costs versus car costs presented before the 1919 conference of the Municipal Tramways Association by A. R. Fearnley, general manager Sheffield Corporation Tramways, is the best presentation of the subject to date. It will be well, therefore, to repeat and supplement some of the figures presented by Mr. Fearnley and



DOUBLE-DECK BUS FOR SHEFFIELD CORPORATION TRAMWAYS

abstracted in the ELECTRIC RAILWAY JOURNAL for Dec. 13, 1919.

The first point to be noted in Mr. Fearnley's paper is that the expenses of different classifications (traffic expenses, general expenses, repairs, road maintenance and fuel) have risen as follows:

Cost per bus-mile in 1915	14.070 cents
Cost per bus-mile in 1918	28.044 cents
Cost per bus-mile in 1919	35.792 cents

It will be interesting to compare these increases with those pertaining to Sheffield cars as presented in the annual report for the fiscal year ended March 25, 1919:

Cost per car-mile in 1915	13.136 cents
Cost per car-mile in 1918	20.344 cents
Cost per car-mile in 1919	24.776 cents

From this it appears that while the bus has risen 21.722 cents per mile since 1915, the car has risen but 11.64 cents per mile. The maximum carrying capacity of the Sheffield buses is thirty-seven each, and of the cars seventy-six, or more than twice as great.

Mr. Fearnley observes that on the basis of unit per unit, regardless of seating capacity, the comparison of operating and fixed charges works out as follows for his conditions:

	Car, Cents	Bus, Cents	Per Cent for the Bus
Operating expenses per mile	24.776	35.792 or	44.5 more
Fixed charges or overhead per mile	3.376	1.846 or	45.3 less
Total cost per mile	28.152	47.638 or	33.7 more

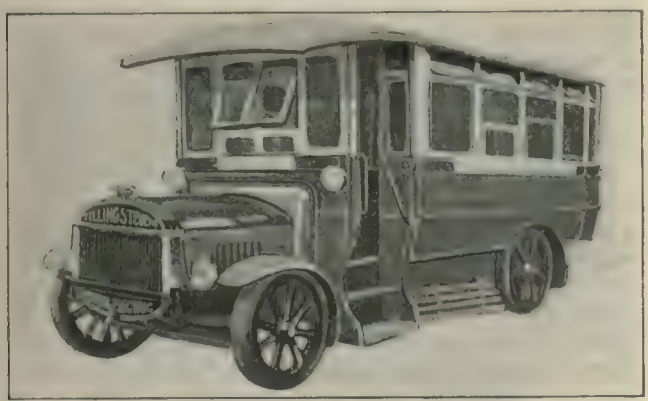
But this is only part of the story, because it is also necessary to credit the car with its greater passenger-carrying capacity. The comparison then stands:

	Car, Cents	Bus, Cents	Per Cent for the Bus
Operating expenses per passenger	1.432	4.274 or	198.0 more
Fixed charges or overhead per passenger	0.196	0.220 or	12.3 more
Total cost	1.628	4.494 or	176.0 more

Upon the basis of passengers actually carried, even the fixed charges were greater with the bus than with the car. Again, upon the basis of number of seats provided per vehicle-mile run, we have the following:

	Car, Cents	Bus, Cents	Per Cent for the Bus
Operating expenses	0.460	1.064 or	131.3 more
Overhead or fixed charges	0.062	0.054 or	12.9 less
Total cost	0.522	1.118 or	114.1 more

The receipts per bus-mile were 40.914 cents compared with 33.326 cents per car-mile, an excess of 23.5



GAS-ELECTRIC BUS WITH FRONT DOORWAY

per cent; while the receipts per seat-mile provided were 1.216 cents for the bus and 0.614 cents for the car, an excess of 98 per cent. Although the bus fares averaged 3 cents a mile against 1.304 cents a mile for the car, an excess of 130 per cent, the higher rate and slightly higher speed were not sufficient to offset the higher cost of giving bus service. With regard to speed, Mr. Fearnley noted that as about three-fourths of the bus operation was in open country, a superiority of 15.26 per cent for the bus (9.97 m.p.h. against 8.65 m.p.h.) was not important. Mr. Fearnley might have added that the speed of the buses would have been considerably less if they had been seventy-six seaters like the cars, and operated under like conditions of traffic.

While the Sheffield management is well aware of the higher cost of the bus on any comparable basis, it does not hesitate to recommend the installation of motor buses where thin-traffic extensions, cross-town routes,



SINGLE-DECK BUS WITH BAGGAGE RACK, USED FOR RAILROAD STATION CONNECTIONS

high-grade residential districts and seasonal pleasure routes are to be served. In fact, it also considers the possibility of paralleling a tramway route, or running toward the same terminus, for purposes of traffic relief.

London General Omnibus Company No Longer a Bonanza

Without questioning the value of the motor bus for the various purposes outlined in these articles, it is necessary to emphasize the fact that the bus does not cure all the difficulties incident to transportation on rails and that it is not exempt from the necessity of earning more than it spends. For these reasons, it is well to look closely into the operations and history of the London General Omnibus Company, because conscienceless bus promotors in this country are pointing it out as the "embodiment of everything that's excellent" in the way of making money. A recent prospectus, for example, declares that: "The £100 shares of the company which stood at £18 in December, 1909, had risen steadily to £400 in June, 1913." How many investors are buying *electric railway* stock on the basis of the quotations of 1913? About as many as are buying London General Omnibus shares after the heavy losses of recent years!

There is no mystery whatever about the status of this company, for, following an application for fare increases, an audit of its books was made last year for the Home Office of the Government by Sir Arthur F. Whinney. Some of the following figures are derived from this report, published in July, 1919:

In 1913, gross earnings per mile were 8.57d. and expenses, 7.10d.
In 1914, gross earnings per mile were 9.14d. and expenses, 7.44d.
In 1915, gross earnings per mile were 10.78d. and expenses, 8.58d.
In 1916, gross earnings per mile were 10.99d. and expenses, 9.26d.
In 1917, gross earnings per mile were 12.72d. and expenses, 11.58d.
In 1918, gross earnings per mile were 15.32d. and expenses, 14.05d.
In 1919, gross earnings per mile were 16.68d. and expenses, 17.71d.*

* From abstract of London General Omnibus Company's Report for 1919 in *Electric Railway Journal* for March 20, 1920, page 620.

Table III on page 686 shows the principal operating expenses for 1913-1918. From these figures it is clear

TABLE III. OPERATING EXPENSES IN PENCE PER BUS-MILE, LONDON GENERAL OMNIBUS COMPANY, YEARS 1913 TO 1918, INCLUSIVE

	1913	1914	1915	1916	1917	1918
Traffic expenses, wages, etc	2 92	3 24	3.70	3 86	4.24	5.26
Maintenance, repairs and renewals	1 52	1 56	2.13	2 47	3.17	3.41
Petrol	1 00	1.16	1.31	1 46	2.60	3.80
Tires						
Other expenses, including administration and depreciation	1 02	1 10	0.59	0 52	0.51	0.50
	0 64	0.68	0 85	0 95	1.06	1.08
Total	7.10	7.44	8 58	9 26	11.58	14.05

NOTE.—Platform expense alone (drivers and conductors) was 2.6d. per bus-mile in 1916, 2.8d. in 1917, 3.7d. in 1918. These increases do not include increases and 8-hour day inaugurated during 1919.

Cost of petrol rose from 7.8d. per gal. in 1913 (when 7.8 miles were being obtained per gallon) to 27.5 d. in 1918. These prices include a net tax of 1.5d. per gallon up to 1915 and a tax of 3d per gallon since 1915.

that all items have advanced except tires. The increases in gross earnings during the latter years of the war are due more to overcrowding than to increased fares. There was so great a shortage of equipment by the end of the war that it was necessary to impress 143 motor trucks into an emergency service that resulted in a loss of 10 cents per mile operated. An idea of the conditions caused by the war is indicated by the fact that in 1918 the operation of 67,197,422 bus-miles brought £4,289,114, whereas in 1914, 99,365,363 bus-miles were operated to earn £3,785,581. That increased fares had little to do with this appears from the following record:

DECREASES IN LENGTH OF AVERAGE PENNY RIDE (IN MILES)

	To Sept. 1917	To Aug. 1918	To April 1919	To June 1919	Since
Central area (including city) west and northwest area	1.60	1 53	1.38	1 25	1 25
Rest of London and suburbs	1 52	1 52	1 46	1 46	1.31

It will be observed that the figures also include changes made during 1919. Nevertheless, the London General Omnibus Company's report for the quarter ended March 31, 1919, showed an operating loss of £9,590, while the deficiency for all of 1919 (as met by the Common Fund payment herewith described) was £424,003.

Returning now to Table III, it will be seen that by the end of 1918 the operating expenses had doubled during the war period in rising from 7.1d. (14.2 cents) to 14.05d. (28.1 cents) for vehicles seating no more than thirty-four passengers. The differential of 1.27d. (2.54 cents) between receipts and expenses in 1918, the year of maximum crowding, has been wiped out by the coming of the eight-hour day, as shown by the figures for 1919.

In the meantime, the majority of the buses had been in use for more than the five years which the company fixes as their efficient life. For this reason, the company had accumulated a reserve fund of £1,904,868 which, however, was over £1,000,000 short of the £3,000,000 needed to replace outworn equipment, with 2,500 forty-six-seaters costing at least £1,200 each. In addition to this renewal fund, the company had on hand the sum of £511,153, derived from the sale of motor buses for war purposes, but this still left it several hundred thousands of pounds short for renewals. The effect of keeping equipment in use for an average of seven instead of five years appears in part from the fact that the maintenance charge per bus per annum rose from £222 in 1913 to £451 in 1918. In other words, the annual upkeep of buses averaging less than thirty-four seats was more than one-third the first cost of the new forty-six-seat bus!

Stripped of all detail, the actual status of the London General Omnibus Company is best revealed by its relationship to the Common Fund established under the London Electric Railway Companies' Facilities Act, 1915, whereby each company (the bus company and the underground lines) pays its own operating expenses, fixed charges and interest on debentures, dividends on preferred stocks and shares (except the second preferred stock in the Metropolitan District Railway) and retains such sums as it thinks necessary for depreciation and reserve. The balance of income is then paid over to the common fund, of which the London General Omnibus share was 40 per cent up to Dec. 31, 1915, and 32 per cent thereafter. The respective London General Omnibus payments follow:

	Paid In	Received
1915	£311,803	£180,546
1916	259,077	162,230
1917	*Nil*	190,396
1918	*Nil*	210,043
1919	*Nil*	424,003
Total	£570,880	£1,167,218

From this it is clear that the London General Omnibus Company is no longer the rich uncle of the famous London combine. It never would have been that welcome relative at any time in its career if buses had been taxed as heavily as trams. Thus, in the year 1915, when the London General Omnibus showed a profit of $1,500,000, it was figured by H. H. Gordon of the London County Council that proportional taxation would have wiped out this profit, for the buses were then paying only $200 each a year as a contribution toward public needs compared with $1,000 per annum by every car in the London area. One must conclude, therefore, that the motor bus, like the electric car, is not gifted with any miraculous powers over the laws of economics.

If anything, the bus has suffered far more from the effect of war increases. Gasoline has risen more than coal; shorter-lived rolling stock must be replaced regardless of cost, and wage increases naturally have been more hurtful to a vehicle employing two people for thirty-four-seats than one employing the same number for seventy-six or seventy-eight seats. Thus, while the bus-mile operating cost rose from 17.16 cents in 1915 to 28.1 cents in 1918, the West Ham Corporation Tramways in East London had a car-mile increase from 15.3 cents in 1915 to 22.56 cents in 1918. The bus increase was therefore 10.94 cents and the car increase 7.26 cents, and the greater increase had to be applied to a vehicle of one-half the capacity of the car.

It is to be hoped that the present Government inquiry into the London traffic situation will result in the elimination of wasteful competition, for it is doubtful whether the London General Omnibus Company can afford to continue along the old lines. On the other hand, it has done and must continue to do its greatest and most necessary work in serving the trackless heart of London where the density of traffic and demand for short-haul riding should still permit profitable operation without a prohibitive increase in rates of fare.

LONDON'S STEAM BUSES ARE WITHDRAWN

In concluding the subject of whether motor buses pay invariably or not, attention is directed to the withdrawal of the National Steam Car Company's buses from London the end of October, 1919. In a statement made on Nov. 14, 1919, by W. J. Iden, managing director of this company, it was declared that the year ended Oct.

31, 1918, had shown a loss of £5,393 in the London area. Between December, 1918, and Sept. 30, 1919, the introduction of higher wages as well as the eight-hour day had added £40,000 a year to the payroll. A further increase of 4 shillings (nominally 96 cents) a week as of Oct. 1, 1919, added £6,250 per annum, with the result that in October there was a loss of 10 cents per mile.

A significant difference between British bus and American electric railway conditions was revealed in connection with this case when a deputation asked for an audience with Sir Eric Geddes, Minister of Transport, to request resumption of service. Sir Eric stated that it would serve no purpose to receive the deputation, for when a company withdrew its vehicles on the ground that traffic was not remunerative, the Ministry could not interfere.

Casual reference has already been made to the capacity of the motor buses used by several undertakings. The largest high-mileage bus to date is the new forty-six-seater of the London General Omnibus Company. This is of the double-deck type with cross-seats top and bottom except that longitudinal corner benches seating three each are used at the doorways of the lower deck. The over-all length of this vehicle from crank handle to rear clearance is 22 ft. 6½ in. and the wheelbase is 12 ft. 10⅝ in. The lower deck is 6 ft. 10 in. wide over all, which is sufficient to permit pairs of cross-seats 2 ft. 8 in. wide and an aisle of 15 in. The platform width is 3 ft. 10 in., an increase of 10 in. made to facilitate passenger interchange. The unladen weight is 7,840 lb., or 170 lb. per seated passenger—an achievement that seems well nigh incredible. This ultra-lightness was a necessity in view of official regulations. The new bus is no heavier than the thirty-four-seater which it is replacing. The approximate unit price of these vehicles was placed at £1,200 during the London traffic inquiry hearings held the middle of 1919. This figure is close to the American costs.



SINGLE-DECK BUS WITH REAR AND FRONT DOORWAYS

The advantage of using the higher-grade metals customary in motor-bus design would appear from the circumstance that both the New York and Pittsburgh double-deck cars weigh much more per seat, despite the fact that these cars represented a great reduction over preceding types. The New York double-deck stepless car weighed 46,000 lb., or 522 lb. per seat, and the Pittsburgh double-deck car was estimated to weigh 487 lb. per seat. (See ELECTRIC RAILWAY JOURNAL for Aug. 10, 1912.) The buses' advantages of using better materials must be admitted even if allowance is made for the fact that the cars are not open-top and that the low-step feature made extra-deep girders necessary.

TYPES OF BUSES—REGULATIONS

The maximum permissible speed of motor buses in London is placed at 12 m.p.h., but the London General Omnibus Company has requested permission to go to a maximum of 16 m.p.m. It is doubtful whether any notable increase in schedule speed would be obtained except on runs with a considerable portion of open running. One can hardly expect also that the improvements in ingress and egress will offset the increased standing time from the greater number of stops incident to changing from a thirty-four-seat to a forty-six-seat vehicle. Hence, anything better than the present schedule speed of 8.5 m.p.h. is hardly to be expected. A considerable saving in platform expense should ensue from increase in capacity, if there is no loss of speed.

The Sheffield Corporation Tramways is another user of double-deck buses. The maximum carrying capacity of the Sheffield bus is given as thirty-seven, compared with seventy-six for the Sheffield car. Manager Fearnley, at the 1919 Municipal Tramways Conference, declared that this size bus was too small for Sheffield peak loads. The rougher roads of the provinces also made it impracticable to use a bus of London lightness. As against 7,840 lb. in London, a bus of 10,080 lb. would be required to stand the harder wear and tear. As previously noted, the schedule speed of the Sheffield buses is 9.97 m.p.h., owing to their large proportion of light traffic conditions.

According to a paper on "Bus Development After the War," read by Eric Cauldwell before the British Institution of Automobile Engineers, the double-deck bus is favored chiefly in London because of the need for capacity. It was possible to build a single-deck vehicle of thirty-four-seat capacity. As a matter of fact, Mr. Cauldwell's idea is borne out in the recent installation by the Birkenhead Corporation Tramways of three single-deck thirty-three-seaters which apparently are intended for pleasure and long-ride traffic, judging by the provision of a compartment for smokers. It might be added that the standard Paris bus is of single-deck type with twenty-eight seats in two compartments.

Most of the buses are made for rear entrance and exit, the one-man near-side operation of small American buses being almost unknown. However, such operation is only a matter of time.

In addition to the standard single-track and open-top double-deck buses. British tramways also operate cross-bench sightseeing type cars, known locally by the French name of char-a-bancs. Such vehicles are used for cross-country service as well as for seasonal riding.

In the London Metropolitan area motor buses and their drivers are licensed by the Metropolitan Police. Elsewhere, the councils of boroughs and other urban districts exercise the same powers. Where rural district councils have not had such powers conferred on them by the Local Government Board, licenses to ply for hire need not be taken out. Generally speaking, there have been almost no legal restrictions to bus development, even for competitive purposes, in comparison with the awkward procedure relative to tramway extension. Under the Ministry of Transport Act passed in 1919, those who are refused licenses may appeal to the Minister of Transport, who has the "power to make such order thereon as he may think fit."

The Motor Car Act, as amended down to 1909, includes the following provisions:

If the unladen weight (exclusive of water and fuel) exceeds 8 British tons (6,720 lb.), the width must not exceed 7 ft. 6 in.; otherwise a width up to 7 ft. 2 in. is specified.

A bus weighing 6,720 lb. (unladen) is restricted to a speed of 12 m.p.h., and one weighing 11,200 lb. (unladen) to 8 m.p.h. If trailers are used, the maximum speed permissible is only 5 m.p.h. (The regulations of the London Police are noted on the preceding page.)

The weight of a loaded motor bus must not exceed 12 British tons (26,880 lb.) nor must the axle weight of any axle exceed the registered axle weight of that axle. A heavy motor car whose axle weight exceeds in the aggregate 6 British tons (13,440 lb.) may not be driven upon any highway bridge when another heavy car or locomotive is on the bridge, except in the case of the Menai Bridge and bridges within London.

The duty payable on a motor omnibus when used as a hackney carriage is 15 shillings (nominally $3.60) plus 42s. ($10.85) if under 2 British tons unladen or 63s. ($15.12) if over 2 tons. Obviously, this charge is not onerous.

PETROL TAXES AND ROADWAY CHARGES

The self-propelled vehicle as a source of revenue was discovered by the British government in 1910, when a tax of 6 cents a gallon was imposed upon motor spirit, which is defined as "any inflammable hydrocarbon, including any mixture of hydrocarbons, and any liquid containing hydrocarbon which is capable of being used for providing reasonably efficient motive power for a motor car." In 1915 the Government took another bite by doubling the tax to 12 cents per gallon. The actual tax for public utility operators using more than 500 gal. a year has always been one-half of these charges, so that the present rate to practically all motor-bus operators is 6 cents per gallon.

The original purpose of the Government was to apply the revenue from licenses and motor spirit taxes "for the improvement, construction and maintenance of roads in the United Kingdom, and to render financial assistance to the County Councils." To this end a Road Board was appointed under the Development and Roads Improvement Funds Act of 1909. Millions of dollars derived from the impositions named were spent upon the improvement of existing roads. By 1915, however, the war led to the suspension of such grants from the National Exchequer, since which time only the interest on the Road Board's investments have been available. The status of the matter is well expressed by the following remark of Sir Eric Geddes, Minister of Transport, before the Nov. 5, 1919, meeting of the Society of Motor Manufacturers and Traders.

"In the petrol tax," Sir Eric said, "the motor industry was contributing more than it got for the maintenance of the roads." So far as his influence could be used, he added, they would get back that tax for its original purpose of road maintenance. The Chancellor of the Exchequer has recently announced that the petrol tax is to be abolished in favor of some other form of impost less easy to evade. For example, users of coal gas, producer gas, paraffin and home-produced benzol pay no equivalent tax. Taxation on the basis of unladen weight, mileage or horse-power is now under consideration.

The motor spirit tax, however, is not the only highway tax which the motor bus will have to meet in the future. The national tax was to be devoted to help out local authorities up to 75 per cent of the net roadway cost. To be on the safe side, local authorities are showing a more and more distressing interest in making bus operators contribute directly to road upkeep at the rate of so and so much per bus-mile operated. The electric railway operator, weighed down by decades of excessive taxes for paving that he does not destroy, will smile a pitying smile when he reads a busman's hope that "any road charges on motor-bus operation should not exceed the true recoupment, and should in no circumstances extend to profit-making for the district."

The road maintenance payments vary considerably in Great Britain. The highest known is that of the Northampton County Council, which has recently granted the National Steam Car Company the right to run between Rushden and Bedford at the rate of 3d. (6 cents) per bus-mile. The next highest within the writer's knowledge is that of 4 cents per bus-mile, plus an initial fee of 1 guinea (say $5), demanded in October, 1919, by the Lancashire County Council. In sanctioning four bus routes, about the same time, the Oxfordshire County Council also demanded 4 cents per bus-mile. On this subject, the London correspondent of the ELECTRIC RAILWAY JOURNAL wrote as follows in the issue of Oct. 4, 1919:

"It is established by several private acts of Parliament that when a local authority works buses over the roads of an adjoining authority the operators pay ½d. (1.25 cents) per mile for road maintenance. Companies can, however, run buses without statutory powers, and some of the English County Councils, before giving consent, demand 2d. (4 cents) per mile run. These powers are of recent origin."

A payment of 2d. per mile would have cost the London General Omnibus Company on the basis of the 67,197,422 miles' run in the year 1918 the ruinous sum of $2,687,896.88, and would have been equivalent to more than 13 per cent of the gross earnings per bus-mile, 15.32d., in 1918.

The Sheffield Corporation Tramways are more fortunate. They pay the road authorities only ½d. (¾ cent) per bus-mile. As of March 31, 1919, they made a five-year contract at this rate with the West Riding and Derbyshire County Councils following five years' experience in operating over the roads of these authorities. Since Oct. 29, 1919, the Stockton Corporation Tramways pay 1½d. (2½ cents) per bus-mile to the North Riding County Council for running over a bridge.

An example of advancing costs is that indicated by clauses of the Walsall Corporation Tramways bill for 1914 and 1919 respectively. In the 1914 act, £275 per route-mile was to be set aside for reconstruction of roads and ½d. per bus-mile for maintenance; in 1919, the figures were £700 per route-mile for reconstruction and ¾d. per bus-mile for maintenance.

That "there's a reason" for continually higher charges for the purpose of road maintenance appears from some figures presented by Sir Eric Geddes in his talk on Nov. 5, 1919, before the Society of Motor Manufacturers and Traders. He stated that it cost £4,690 per mile to surface a 40-ft. water macadam road and £7,700 per mile to surface a tar macadam road. A high-grade asphalt road would cost £18,000 per mile, and a wood-paved road, £47,000 per mile. The Government could not build better roads without levying upon their users.

It will be evident from the foregoing that the motor bus in Great Britain is now attaining the same status from the standpoint of taxation as the tramway. Consequently, its future development promises to be even more closely than in the past in fields for which it is especially adapted and in which a higher rate of fare is permissible than is charged on city and suburban railways. Only a great decrease in the cost of fuel and in the upkeep and replacement costs of the motor bus could alter this situation.

In the following article a study will be presented of American conditions.

A. R. E. A. Convention Makes New Record

At Recent Meeting in Chicago Engineering Association Adopts New Bridge Specifications and Specifications Prohibiting Use of Twisted Bars in Concrete

THE twenty-first annual convention of the American Railway Engineering Association, held in Chicago from March 16 to 18 inclusive, surpassed the record of any previous convention both in attendance and in volume of important committee work passed upon. The attendance exceeded by more than 100 any previous convention and reports of twenty-two standing committees and two special committees were presented. A number of the reports of interest to the electric railway field were abstracted in the ELECTRIC RAILWAY JOURNAL March 27, page 652. Two reports of special importance, on stresses in railroad track and on electricity respectively, are abstracted at some length elsewhere in this issue and the remainder of the reports are abstracted briefly below.

A. R. E. A. REPORTS OF ELECTRIC RAILWAY INTEREST

Conservation of Natural Resources. In the presentation of this report the committee emphasized the necessity of salvaging all old materials removed from building, track and rolling stock and explained how this could be done. Reports of reclamation work on several railroads were given. A section of the report which was highly commended was that concerning the conservation of human life and energy. These parts of the report were received as information. Rules for the prevention of the spread of forest and field fires were given also and approved for publication in the Manual.

Economics of Railway Location. The report of this committee dealt with resistance of trains, effect of curvature on cost of maintenance of way and on maintenance of equipment, effect of train resistance on fuel consumption and effect of electric locomotives on economics of location. On the subject of curvature the committee quoted from tests made on the Canadian Pacific Railway, apparently establishing the fact that when the diameter of the outer wheels exceeds that of the inner wheels by an amount sufficient to compensate for the increased distance traveled by the outer wheels the wheels hug neither one rail nor the other, regardless of speed from 5 to 25 m.p.h.

In regard to the influence of the electric locomotive on the economics of location the committee presented two monographs on the subject. These explained the different characteristics of steam and electric locomotives and stated that net savings in fuel cost of 50, 60 and 67 per cent respectively might be expected in passenger, freight and switching service by the use of electric locomotives. Engine repairs were said to be reduced 50 per cent. The effect of rise and fall, curvature and rate of grade were explained and the results obtained on several electrified steam roads were recorded.

Iron and Steel Structures. The adoption of new steel bridge specifications presented by this committee was one of the important actions taken by the convention. A 16-ft. width for the clearance diagram was objected to by several speakers, but was adopted. This width is not required, however, in new bridges built on old masonry where extensive reconstruction would be made necessary. E-50 loading as an alternative for E-60 was suggested, but the latter was adopted. The specifications provide 90, 80 and 75 per cent of the live load, including impact, for two, three and four tracks, respectively. Clear tie spacing of 7 in. is specified, as are also rounded ends for through-plate girders. The latter are said to be important in the case of derailment of cars. Specific permission for the welding of minor defects in castings was eliminated from the specifications upon motion.

The committee's report also included a new column formula of the straight-line type, as a substitute for that of the parabolic type submitted last year. Principles for detailed design of flashing, drainage, reinforcement and protection for waterproofing purposes were given and the reasons for continuing the use of the Cooper system of live loading instead of some specific modern engine loading were dealt with.

Wooden Bridges and Trestles. This committee presented, in the nature of a progress report, specifications and classifications and grading rules for lumber and timber to be used in the construction and maintenance of way departments.

Records and Accounts. The report of the committee covered cost-keeping methods and statistical records, forms for analyzing expenditures, forms for maintenance of way and structures, for construction and for records.

Rules and Organization. Rules in considerable detail for the inspection of bridges, trestles and culverts were submitted by the committee and were adopted.

Signs, Fences and Crossings. The committee introduced a design for an approach warning sign and this was adopted. A report was made on grade elimination.

Signals and Interlocking. On the subject of ties treated with any solution which affects the length of track sections the committee recommended that as the electrical conductivity of zinc-treated ties decreases with age better results may be had by allowing the ties to season for from 2 to 6 months before using in a circuited track. Also that for best results the number of zinc-treated ties installed per year in any track circuit should not be greater than 15 per cent of the total number of ties in that circuit.

Masonry. The specifications for plain and reinforced concrete, prepared by this committee, were adopted, as also was the report on methods of depositing concrete under water. There was considerable discussion concerning the proposed specifications for billet-steel concrete reinforcement bars specifically prohibiting the use of twisted bars. It was stated that hot-twisted bars are dangerous and that cold-twisted bars give no advantage over plain or deformed bars. The specifications were adopted.

Wisconsin Utility Men Meet

Twelfth Annual Convention of Electrical Men Considers Safety Cars, Automatic Substations, Labor Welfare and Publicity at Well-Attended Two-Day Session

THE necessity and value of well-planned educational publicity and the possibilities for the improvement of labor conditions through a high-purpose development of living conditions and leisure-time occupations held the interest of a large attendance at the joint meeting of the Wisconsin Electrical Association and the Wisconsin Gas Association at the Pfister Hotel, Milwaukee, on March 24. The Gas Association had been in session on March 23, concluding its convention with the joint meeting of March 24, while the Electrical Association continued its twelfth annual convention, which began with the joint session, through March 25, President W. C. Lounsbury presiding on both days. The joint session on March 24 was concluded by a splendid banquet in the evening, at which Edward J. Dempsey, Oshkosh, Wis., was toastmaster and James H. McGillan, Green Bay, Wis.; M. H. Aylesworth and William Rainey Bennett were the speakers.

The labor welfare problem came before the joint meeting through a paper on the "Leisure-Time Factor," by William C. Knoelk, executive-secretary of the Community Service of Milwaukee. In the discussion which followed the paper several delegates spoke of the irresponsibility of unions and of the fact that it was not the eight-hour day nor entirely a question of wages that seemed to be the fundamental causes behind the present labor unrest. The representation of labor in the management of a corporation and the close contact which this afforded between management and employees were commented upon as being highly desirable. M. C. Ewing, Wausau, said that it had been his experience that trainmen do not desire an actual eight-hour day, and he cited as proof of this the fact that they continually choose the longer runs, since these pay the most money.

Concluding the discussion on his paper, Mr. Knoelk endeavored to emphasize that he was not interested in the actual eight-hour day nor the length of the working day, primarily, but rather the value of preparing and planning for the leisure time. He said that we should not become impatient if welfare work conducted along the right lines did not seem to produce immediate results; that it would take considerable time to overcome the feeling which many workmen have, regardless of what the facts may be, that they have been mistreated in the past. He explained what this feeling now is by quoting a labor leader of a striking union as saying: "Thirty years' experience has taught us how to handle the situation when we have the other side where we want it." It will take time to overcome this feeling, but a proper provision for occupation during leisure time will prove to be very effective.

Organized Publicity Plan Recommended

B. J. Mullaney, chairman Illinois committee on public utility information, addressed the joint session of the associations on the work which has been done by his committee in Illinois toward educating the public to a real understanding of the public utilities, and recommended that a similar committee be established in Wisconsin. Mr. Mullaney presented the need for publicity work generally from a new angle when he pointed out that it often happens that when a public utility commission has completed its study of a situation and is about to make an order it is confronted with an aroused public sentiment which places the commission in a very unfavorable position. He said that we are only fooling ourselves when we condemn a commission for not having the backbone to make a determined decision in the face of public criticism; that the whole question gets back to the fact that the public holds in its hands the lives of the commissioners, who in turn hold the lives of the companies. Hence we must have publicity which will educate the public to an understanding of the utility business so that commissions will not be restricted in their free and deliberate functioning. Much of the opposition of the public comes from suspicion and ignorance, so that it devolves upon the companies to dispel this ignorance of public utility affairs.

Mr. Mullaney then explained the manner in which the Illinois committee had gone about this important work of educating the public and brought out the policies which have guided the committee from the first. He told of the splendid success which had been realized in securing the publication of utility matters in the public press and gave proof of the change in public attitude resulting therefrom.

The speaker was anxious to inspire the formation of a similar organization and work in Wisconsin and urged the association to give the matter serious consideration. He quoted Charles L. Henry, Indianapolis, Ind., as saying that if the formation of the Indiana committee on public information accomplished nothing else than the co-operation between the various utilities of the State, which had already been realized in a splendid measure, the organization would be worth while.

Mr. Mullaney and the Insull interests are working toward the formation of such a committee in every state, believing that the work can be more effectively handled through state units than through the national associations of the several utility industries. He explained that later on it may be possible for such state units to come together in convention or to co-operate in some other manner to give the work a national scope. The aim of such a magnificent educational work is to make the utility business just as safe from attack as the churches and schools, the speaker explained.

Asked about the cost of carrying on this publicity work, Mr. Mullaney explained that the cost to the Illinois committee was $15,000 for the first year. He said that this was abnormally high on account of the very wide distribution, free, of nearly all of the literature got out. He said that the Indiana committee estimated that an assessment of one-fiftieth of one per cent of the gross revenue of the utility companies of the State would carry on the work for a year.

At the conclusion of Mr. Mullaney's talk the association passed a resolution giving him a vote of thanks and recommending that the new executive committee take up the consideration of his suggestions, looking toward some definite plan.

PRESIDENT LOUNSBURY'S ADDRESS

Upon the adjournment of the two associations the twelfth annual convention of the Electrical Association was called to order by President Lounsbury, who then read his address. In this he called attention to the fact that the Wisconsin Electrical Association now has a history to which the members can point with pride, for it has won the respect and confidence of the State governing boards and has lent a forceful influence in the betterment of service rendered the people of the State. He pointed out that one of the fundamental objects of this association was to encourage a friendly relation between companies and the public. He said this could be obtained by creating a public faith in the properties represented by the delegates, provided first that these delegates have an abounding faith in them themselves. He lamented that utility operators were inclined sometimes to make apologies for the product of their business and the rate charged for it, whereas in reality these utilities are rendering service to the communities at a cost much less than the actual value to the community. To emphasize his point, he quoted Henry L. Doherty as saying:

"In the wave of antagonism against corporations throughout the country we are the ones most likely to be reached and harmed, and we can go to greater ends in correcting this antagonism of the public toward corporations than any one else. . . . There is nothing that creates faith in the company like having the man who works for it say the company is all right and honest and straight."

Mr. Lounsbury went on to say, in regard to employees, that the policies of the utilities must be so formulated as to secure "fairness to labor, fairness to stored labor, which is capital, and fairness to the public. We must not expect our employees to stand the brunt of our trouble; they must be well paid or in the long run the industry will not carry on."

Speaking of the future work of the association, Mr. Lounsbury expressed the belief that this would be better handled by creating several active standing committees of three members each, which would report annually after study carried on through the year. In this connection, he recommended the appointment of a membership committee, a committee on taxation, a committee on accounting, a committee on legislation, a street railway committee, a commercial and sales committee, a committee on rural service extension and a committee on interconnections of power plants. These recommendations were later adopted by vote of the association.

M. A. Aylesworth, executive manager of the National Electric Light Association, addressed the association on the "Relations of the Central Stations to the Public."

DISCUSSIONS ON SAFETY CAR PAPER

E. M. Walker, Terre Haute, Ind., who had been invited to come to Milwaukee as the guest of the association for the purpose of presenting a paper on "Possibilities of City Street-Car Operation," was heard at the morning session on March 25. Mr. Walker's paper appears in abstract elsewhere in this issue. It was very well received, the delegates seeming to be very much interested in the possibilities of economies and increased revenue which were modestly shown to be available through the use of safety cars.

B. W. Arnold, in discussing Mr. Walker's paper, said that he was operating 100 per cent with safety cars in Oshkosh. He called attention to the mistake that had been made in placing the standard safety car, which was developed in the South for a warm climate, in Northern cities, where the temperature in winter is much lower. He had found it necessary to have his safety cars built with double flooring and with inside sheathing and head lining in order that passengers might be comfortable in winter. He said that the people of Oshkosh were all boosters for the safety cars.

F. L. Markham, American Car Company, explained that it was not the practice of the manufacturers to build a car for Wisconsin cities the same as they would for Southern cities, saying that some mistakes of this character had been made in the early installations of safety cars. Cars for Northern cities are now not only being built warmer but equipped with twelve instead of eight electric heaters, with one additional on the platform for the operator. He pointed out that many improvements have been made in the last five years in the design and equipment of the safety cars and that the manufacturers stand ready to make further changes.

Questioned as to the manner of flagging safety cars and the earnings per car-mile, Mr. Walker replied that the earnings in Terre Haute averaged a little better than 21½ cents per car-mile. He said that there were seven grade crossings in Terre Haute, five of which were trunk-line crossings, and that a ground flagman was employed at each crossing. The interurban cars also get the benefit of these crossing flagmen. He said that the cost of flagging all crossings in this manner was about 1½ per cent of the gross operating expense, which he considered a very small item when looking upon it as an insurance measure. Mr. Arnold made a rapid calculation and commented that if it were necessary to employ a flagman at every crossing in Oshkosh for the sake of using one-man cars he could put two men on each car and then save three men. He said that his operators are required to bring their cars to a stop at a safe distance from a crossing, leave the cars and flag themselves, then return and run the cars across. This procedure is now required by the Wisconsin laws. The object in making a man leave his car, he explained, is that it made sure that the car will be stopped prior to crossing.

J. P. Pulliam, after hearing Mr. Walker's paper, said that there was no question but that the street railway industry had been asleep for many years. He said there were any number of cities in Wisconsin in which the headway of the cars was the same now that it was twenty years ago. He thought that the safety car offered a way to give the service the people wanted and ought to have, and he thought railway operators should keep their ears and eyes open for new developments and be prepared to make the most of them. He said that the safety car might not be the last word in urban transportation, but that it was certainly a great improvement in the art and should be taken advantage of.

J. N. Canby, consulting engineer, Madison, in discussing a paper by Paul Stark, which was entitled "Investment or Cost of Reproduction Less Depreciation" and advocated the investment method of valuation and criticised the deduction of depreciation from capital value, said that the courts and commissions had determined that the method of fixing rates

on the depreciated value of a property was obsolete, so that it would seem Mr. Stark's paper was based on a misleading assumption. The Wisconsin Railroad Commission has defined depreciation as an operating expense of that amount which must be regularly set aside to keep a property in proper operating condition. Mr. Canby said that he was inclined to believe that the investment value of a property should be used for rate-making purposes in abnormal times, since the value on the basis of cost of reproduction new in such times would result in rates which were too high.

At the meeting on Thursday afternoon C. A. Butcher presented a paper illustrated with lantern slides on "The Development of Automatic Substation Equipment." This paper had to do mainly with the installation of automatic equipment in railway work, but the author also discussed briefly the possibilities of its application to industrial substations. His paper appeared in abstract in the issue of the ELECTRIC RAILWAY JOURNAL for March 27. This was followed by 2,000 ft. of moving pictures illustrating methods of creosoting, presented by a representative of the Barrett Company.

The following officers were elected to direct the affairs of the association during the coming year: President, W. C. Lounsbury, general manager Superior Water, Light & Power Company; first vice-president, L. N. Boisen, vice-president Ashland Light & Street Railway Company; second vice-president, Harold Geisse, vice-president Wisconsin Power & Light Company, Janesville; third vice-president, P. D. Kline, second vice-president and general manager Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis.; secretary-treasurer, J. P. Pulliam, vice-president Wisconsin Securities Company, Milwaukee.

Possibilities of City Street Car Operation*

A Tribute to the One-Man, Light-Weight Car by a Manager Whose Property Will Soon Be on a 100 Per Cent Safety-Car Basis

BY E. M. WALKER
General Manager Terre Haute (Ind.) Traction & Light Company

THE effect of enlisting the popular interest in the street railways during the past few years has been at least to show that they are a necessity, and as such that they must and will be made self-supporting. Bearing this in mind, it must be contended that the industry has possibilities.

The street railway developed with the idea of selling rapid transit to people living in and near cities. As the communities grew the railway company found that it had to furnish rapid transit to an increasing number of people, hence the tendency was to increase the size of cars. With increased size, of course, came increased weight, with the other things that go along with it, namely, heavier track construction, more power and much more investment of capital. All went well for a time, though it became evident that with large cars it was increasingly expensive to move empty seats. Hence there was not much incentive to provide more frequent service, so that the needs of the people had to be met rather by the regularity than by the frequency of the schedule.

With the appearance, in numbers, of the private automobile, and then by easy and rapid stages the low-priced automobile and the jitney bus, the public began to experience the pleasure of frequency as well as regularity of service. Instead of waiting on the corner ten minutes for a car Mr. Citizen began to want to go up town "right now," and his wants either found expression in complaints as to the inadequate service of the street car company or in patronage of the jitney bus. It was manifestly impossible to improve the frequency of the service with large, heavy-weight cars at the old rate of fare, especially after war-time costs of operation had become a fact, and therefore it quite suddenly became a question of one of two things—higher fares or smaller, lighter cars, if more frequent service were to be given.

In speaking of the possibilities of street car operation I shall draw attention principally to the safety car, because its possibilities have been demonstrated so effectively in so many places and because it has furnished the means of providing quick, frequent and satisfactory street car service at a reduced cost of operation. The safety car first began to be talked of and written about in 1917, and since that time no less than 3,000 safety cars have either been delivered or are being built for early delivery for more than 125 American cities located in practically every state in the Union.

In April, 1909, it was my privilege to present a paper at the annual convention of the Iowa Street Railway Association, at Cedar Rapids, in the course of which paper the following statement appeared: "In many cases the size of cars has been reduced, as it has been found that smaller cars, operating at more frequent intervals, have made possible a vastly improved service and at the same time a reduced car-mile cost of operation." At that time there was probably but one automobile owned in the State of Iowa for every hundred now owned, so that there was no competitive force to bring out the thought. The conditions were that we were operating in a small town in eastern Iowa closed cars in the winter time weighing 14 tons each and in the summer time small six-bench open cars weighing only about half as much. One could not help being forcibly impressed with the great reduction in power required to operate in the summer time. And then, too, about 50 per cent of our annual earnings came during the period of the four or five months of the light-weight car operation.

The impression of the light-weight car was lasting. So abiding was that impression of eleven years ago that our property in Indiana now operates practically 100 per cent safety cars. It owns sixty-six standard safety cars, of which ten are still to be delivered. When they are delivered the installation will be complete. The result is, in 1919 more people rode on the cars than ever before, even with but 50 per cent safety car operation. Car-miles increased more than 30 per cent and power used on city lines increased only 4 per cent. The first quarter of 1920, with more than 90 per cent safety car operation, shows an increase in car-miles over 1919 of slightly lower than 30 per cent and an increased number of passengers riding on the cars of somewhat more than 30 per cent.

Aside from the mere statistical aspects of safety car operation, there are other phases that illustrate its bearing on the subject. An analogy to the safety car is presented in the skyscraper. Let us suppose that our problem is to design and plan the elevator service for

*Abstract of a paper presented before the Wisconsin Electrical Association, Milwaukee, March 24, 1920.

an office building of twenty stories. Having a given space at our disposal in which to build the elevators, we should not hesitate long on the question as to which would provide the more satisfactory service, a small number of large capacity cars or double the number of cars of half the capacity. At once we would decide on the larger number. And so it is with the safety car. Its function is to make possible two car-miles where there was only one before. If it will perform that function it will please the people and attract passengers. Car-miles are what we have to sell, and we must be prepared to furnish all the car-miles that the people will buy.

Occasionally comment appears in the newspapers in cities where the adoption of the safety car is suggested implying that the car is suitable only for small towns. Nothing could be farther from the truth. Making possible, as it does, a much more frequent service, it is readily adaptable to almost any condition of city street-car service. In fact, it would seem almost capable of mathematical demonstration that safety cars running on one-minute headway, seating thirty-two passengers per unit, would give a much more satisfactory service than cars weighing more than twice as much as a safety car, seating fifty people each and operating on a two-minute headway. One might easily have his doubts resolved by getting the verdict of the riding public on this point.

Some antagonism to the safety cars is often prompted by sympathy for the man who will be out of a job on account of one-man operation. It works out in practice, however, that by having cars that one man can operate more safely, more quickly and more efficiently than two men can operate the old-style car we have in fact more men to operate more cars.

There is another phase of one-man operation. As the operator is in sole charge of the car and on his own resources he accepts more responsibility and becomes more nearly a business man. As such, he can and does render more satisfactory service both to public and company. This statement has been confirmed by conversation with many of the 150 men operating safety cars in our city, and as an added confirmation, such a thing as a complaint of discourtesy or inattention on the part of a safety car operator is practically unknown. This sort of complaint used to be a very frequent source of annoyance.

Accidents Are Reduced Four to One

The safety of the car, as evidenced by the great reduction in accidents following its use, is another of the possibilities. Step accidents, which usually arise from boarding or alighting while the car is in motion, are unknown with the safety car. Personal injuries are very rare, and such as do occur are not in any sense peculiar to the type of car. Careful records extending over a period of sixteen months of safety car operation, during which this type of car has made in actual service more than 2,000,000 car-miles, have shown an accident cost which is only about one-fourth of the cost of accidents occurring with the non-safety type car operating about two-thirds of that mileage in the same period of time, expressed in terms of cost per 1,000 car-miles.

One other criticism of the safety car has to do with the life of the car. It is said that the car is so light that it cannot last very long. Analyzing this, we find that 75 per cent of the car, with proper maintenance and renewal of wearing parts, ought to last at least twenty-five years. By this is meant the truck, motors, brakes, safety devices, wiring, etc. This, then, would leave but a small portion of the car, from the standpoint of value, to be renewed during the life of the other 75 per cent. Cars of this type that have made more than 50,000 miles and have carried more than 250,000 people are coming out of the shops, overhauled and repainted, looking like new.

Down our way the people like the safety car. They frankly say that the service was never so good and that they would not willingly go back to the old system. At first a good deal of fun was made of the car on account of its size and its radical difference in appearance from the "orthodox" type of city car. But the people soon began to warm up to it, and when one now sees anything about the car in the papers, as he may occasionally, there is almost a suggestion of affection in its designation, which has become a standard with one of our papers, as "the little green car."

Wages of Employees Increased 151 Per Cent

ACCORDING to the last annual report of the Philadelphia Rapid Transit Company the average wage per employee has been increased from $622.16 per annum in 1910 to $1,581 in 1919, or 151 per cent. Greater efficiency is also evident in the 120 per cent more traffic units produced per trainman. The rides per capita have also increased in the same period 47.5 per cent. This means 288 rides per capita in 1910 as against 425 in 1919. The total wages paid to all employees in 1919 were $16,415,008 as against $7,282,995 in 1910, equivalent to an increase of 125 per cent in the payroll.

With the maximum rate of 58 cents per hour, the wages of trainmen, it is said, average $5.51 per day as against $5 per day in Cleveland and $5.10 in Detroit, where the maximum rate is 60 cents per hour.

The Dilemma of the Tramways

FROM the following editorial in a recent issue of the *Electrician*, London, the financial crisis in the electric railway business is an international one:

If we are to judge from a memorandum drawn up by a sub-committee of the Municipal Tramways Association, the municipal tramways of this country (England) are in an alarming financial state. We cannot say that we are surprised. Many municipal tramway schemes were "born out of due time" and, like many such children, have not only been weakly but have had time and money spent on them which have been denied to more healthy progeny. But all the care has done them little good. They have always been ailing and now their state is critical. "Almost every tramway system," says the memorandum, "is being carried on at a loss, which, in many cases, is more than 1d. per car-mile." Then, in addition, there is the usual demand for increased wages from the employees and the usual hostility of the public to an increase in the fares. A conference of tramway authorities is to be held in London next week (first week in March) to examine the patient, but the general secretary thinks that if the tramway industry is to be continued either the fares must be substantially increased or tramways must depend upon compulsory local rates. In other words, if the townspeople won't pay directly they must pay indirectly. Not a very happy state of affairs! But of the two we think the former more preferable, as it is essential in our opinion that the rider should pay at least the actual cost of the ride. The aim of the association should be to make each undertaking self-supporting and to get rid of subsidies as soon as possible. Some tramway systems have, however, never been in that fortunate position, owing to well-known reasons not unconnected with local politics, and it looks now as if they never will be.

The Interborough Rapid Transit Company Keeps Its Patrons Well Informed on Traction Matters

The Subway Sun

Tax Rate and Car Fares

The Board of Estimate is faced by a budget ... but experts agree that the tax rate will mark a new high record.

* * *

This increased tax, under present conditions, will be largely passed on to tenants, in still higher rents, and to customers in still higher prices.

Under a 5-cent fare the city gets no return on its $250,000,000 Subway investment. Therefore it must include in the budget and raise by taxation several million dollars, to pay interest on money borrowed to help build subways.

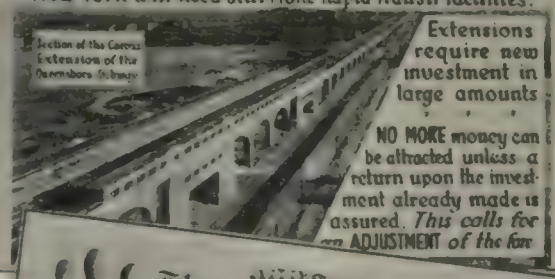
* * *

An increased fare would give the city a profit on its Subway investment, thus cutting down taxes, rents and prices.

The Subway Sun

THE CITY'S *FUTURE*

New York will need still MORE Rapid Transit facilities.

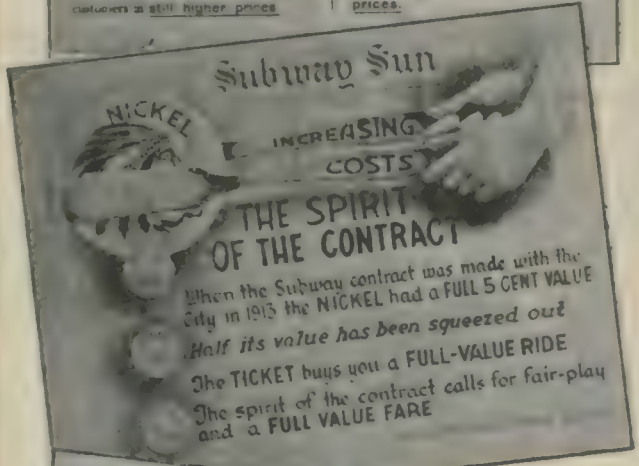


Extensions require new investment in large amounts

* * *

NO MORE money can be attracted unless a return upon the investment already made is assured. *This calls for* an ADJUSTMENT *of the fare*

Subway Sun



INCREASING COSTS

THE SPIRIT OF THE CONTRACT

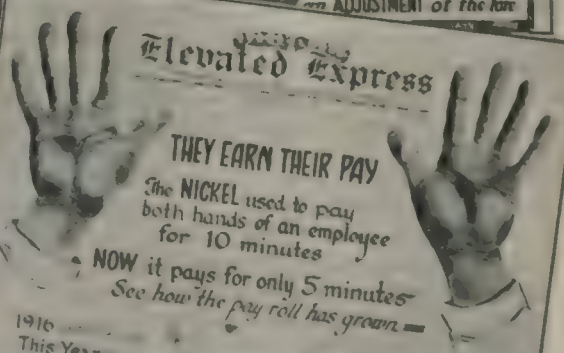
When the Subway contract was made with the City in 1913 the NICKEL had a FULL 5 CENT VALUE

Half its value has been squeezed out

The TICKET buys you a FULL-VALUE RIDE

The spirit of the contract calls for fair-play and a FULL VALUE FARE

Elevated Express



THEY EARN THEIR PAY

The NICKEL used to pay both hands of an employee for 10 minutes

NOW it pays for only 5 minutes

See how the pay roll has grown

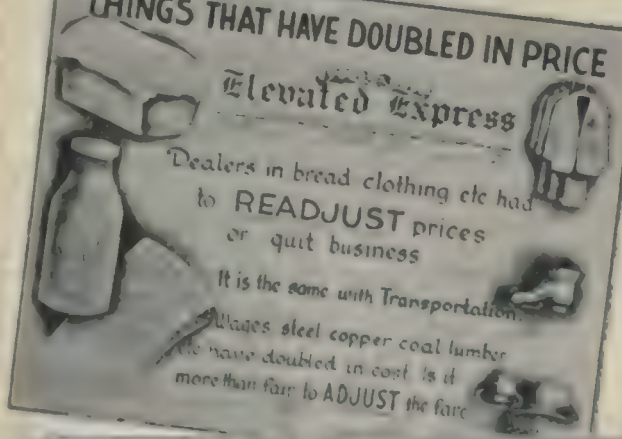
1916 ..... $ 8,308,629

This Year ..... $ 16,808,750

ONLY AN INCREASED FARE WILL MEET THE

THINGS THAT HAVE DOUBLED IN PRICE

Elevated Express



Dealers in bread clothing etc had to READJUST prices or quit business

It is the same with Transportation

Wages steel copper coal lumber etc have doubled in cost Is it more than fair to ADJUST the fare

The TICKET costs you the same

Elevated Express

COAL



RESTORING THE POWER OF THE FARE

The Job of the Car fare has changed too big for it The cost of things for your SERVICE has doubled



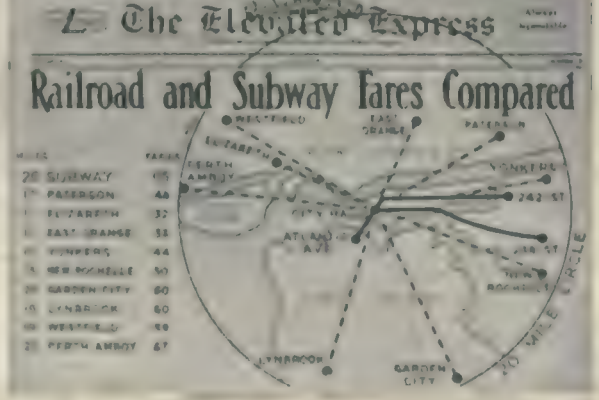
Through the Opening of New Lines the TICKET has GROWN in value

ADJUSTING the FARE is keeping GOOD FAITH

20 MILES ON THE SUBWAY FOR A NICKEL

The Elevated Express

Railroad and Subway Fares Compared



Subway Sun

THE American News Company, Inc. has informed newsdealers that The New York American will increase the price of the Sunday American, commencing February the 8th, to 10 cents retail.

We believe increased costs of labor and materials justify this. We are asking a "fair fare" for identical reasons.

The A. R. E. A. and Electrification

Committee on Electricity Gives Results of Study of C., M. & St. P. Electrification and Reports on Topics Having General Bearing on Application of Electricity to Heavy Traction

AT THE meeting of the American Railway Engineering Association held in Chicago, March 16 to 18 inclusive, the committee on electricity, of which Edwin B. Katté is chairman, reported on the following assignments: (1) Critical examination of subject matter in Manual. (2) Continuation of collection of statistical data relative to clearances of third rail and overhead working conductors. (3) Continuation of revision of joint specifications for transmission line crossings. (4) Report on study of electrolysis and its effect upon reinforced concrete, etc. (5) Report on study of maintenance organization and its relation to track structures. (6) Report upon utilization of water power for electric railway operation. (7) Report on recommended practice for mitigating interference with telephone and telegraph lines. (8) Co-operation with Bureau of Standards in preparation of safety codes. (9) Submit specifications for insulated wires and cables.

In the following abstract attention will be concentrated upon those topics of most immediate interest in the electric railway field. Reference has already been made to the subject of overhead crossings, the specifications for which have now been adopted by all of the associations concerned. This matter was considered in detail at the convention of the A. E. R. E. A. at Atlantic City last fall.

Co-operation with American Committee on Electrolysis

The sub-committee on electrolysis and insulation, comprising Martin Schreiber, chairman; D. J. Brumley, R. D. Coombs, E. B. Katté and F. E. Wynne, reported on the activities of the American committee on electrolysis and on a study of the effect of electrolysis on reinforced concrete.

On the first of these topics it was said that the American committee had now formed a research sub-committee, which will actively engage in technical investigations, both in the laboratory and in the field, collaborating with the United States Bureau of Standards. On this research sub-committee the A. R. E. A. is represented by Mr. Katté and the A. E. R. E. A. by R. F. Stevens and P. W. Ripple.[1]

The sub-committee will take up the study of the auto-transformer system, will join with the Bureau of Standards in the survey of conditions at Des Moines, Iowa, and will investigate pipe drainage with particular reference to drainage at joints. At a meeting of the sub-committee held on Sept. 22 a committee was appointed to investigate pipe-joint corrosion and soil corrosion, the investigation to be made in cities where large current is carried by piping systems and in cities where mains are to be uncovered during maintenance work.

A meeting of the sub-committee of the American committee on technical features of construction in operation was held on Sept. 26 to plan for a portion of the report of the main committee having to do with this topic. The work has been divided up into these sections. (1) Railways. (2) Affected structures. (3) Measures applicable to railroads. (4) Measures applicable to affected structures. (5) Joint responsibility of interests and necessity for co-operation. The first section is in charge of Prof. A. S. Richey and the last in that of Professor Richey, H. S. Warren and S. S. Wyer.

As to the effect of electrolysis on reinforced concrete the committee referred to its 1918 report, in which the conclusion was stated that the disintegration of concrete may be laid at the door of electrolytic action to a certain extent, but that it is possible so to design and install concrete work as to reduce this disintegration to an almost negligible amount. This year the committee suggested consideration of the subject along the following lines: (1) The use of copper-plated reinforcing bars. (2) The introduction of reinforcing bars made of a copper alloy. (3) The surrounding of the reinforcing bars with a rough enamel. (4) The installation of a waterproofing structure around ordinary structures in salt water, this waterproofing to consist of a plastic layer of material with petroleum asphalt as a basis, or some established waterproofing material free from electrolytes. The plastic casing should be finally protected with another layer of concrete or masonry material.

The St. Paul Electrification and its Lessons

An important report on the subject of water power for the generation of electricity for the operation of trains was made by a sub-committee consisting of George W. Kittredge, chairman; W. L. Morse, vice-chairman; A. H. Armstrong, D. J. Brumley, R. H. Ford, M. Schreiber and F. E. Wynne. It was taken up with the results of a study of the electrified section of the C., M. & St. P. Ry. between Harlowton and Deer Lodge. Electric power for this is obtained from the Montana Power Company, and several of the more important water-power developments of this company were inspected by the committee. Some high spots of the report follow:

The Montana Power Company was organized in 1912 for the purpose of consolidating and unifying the business of power systems then owned by the Butte Electric & Power Company, the Missouri River Electric & Power Company and their respective subsidiaries. Subsequently the Montana Power Company acquired the Great Falls Power Company and the Thompson Falls Power Company, and by virtue of the original consolidation proceedings the Montana Power Company became vested with title to all of the properties, rights and franchises of the system owned by the Butte Electric & Power Company, the Missouri River Electric & Power Company and their subsidiary and associated companies. The Great Falls Power Company and the Thompson Falls Power Company have been continued as separate cor-

[1] An article on the organization of the research sub-committee and on the plan and scope of its work will appear in an early issue of the ELECTRIC RAILWAY JOURNAL.—EDS.

porate entities. This has given the Montana Power Company the ownership of all the undeveloped power sites on the Missouri River in the vicinity of Great Falls, which were owned for more than twenty years by the Great Falls Power & Townsite Company, organized and owned by the late James J. Hill and his associates.

The Montana Power Company has developed and now owns twelve hydro-electric plants and four steam plants. It develops 290,000 hp. and has about 1,900 miles of high-tension lines with seventy-five substations. From five of the more important hydro-electric plants, high-tension power lines, approximately 250 miles in length, radiate to and connect with five substations of the C., M. & St. P. Ry. These five plants are: The Madison plant on the Madison River, 12,000 kw.; the Holter plant on the Missouri River, capacity 40,000 kw.; the Rainbow Falls plant on the Missouri River, capacity 35,000 kw.; the Great Falls or Volta plant on the Missouri River, capacity 60,000 kw., and the Thompson Falls plant, located at Clark's Fork, capacity 30,000 kw.

The Montana Power Company has much greater capacity than is required for the railroad, and the additional power is used for other commercial purposes.

Committee Indorses Judicious Electrification

The committee reported that the C., M. & St. P. installation has demonstrated that the transmission of railway electric power over long distances is efficient, economical and reliable at 110,000 volts. The multiple feed points at which the power company's separate lines connect to the railway lines are desirable because: (a) they secure for the railway the advantages of duplicate transmission lines with the actual construction of a single line, and (b) they permit the use of the railway lines for transferring power between the power company's lines.

Furthermore, cedar pole construction with treated-butt H-frames for the power company and single poles for the railway company, under Montana conditions, is reliable and more economical than steel towers both in first cost and annual cost. No. 00 or equivalent diameter is the minimum size of cable for avoiding corona losses at 110,000 volts in this climate at these altitudes. Satisfactory lightning protection is obtained by the use of lightning arresters at the power houses and substations with a ground wire along the transmission line. The minimum spacing of the conductors is 9 ft. apart for 110,000 volts and has proved adequate. Adjusting the tension in the conductors so that at 0 deg. F. with 1½ in. sleet coating and wind pressure of 8½ lb. per square foot the stress will be slightly below the elastic limit produces a satisfactory construction in this territory. Transposition of telephone wires every half mile and of the railroad's dispatching telephone wires every 900 ft., without transposition of paralleling power wires, gives adequate correction of interference. It is practicable to employ short cuts for the railway transmission lines by leaving the right-of-way where track curvature is great. Sectionalization of the power company's lines by switching stations fifteen miles apart provides for rapid location and correction of line failures. The sectionalization secured on the railway company's transmission line by looping it through substations, spaced approximately 32 miles apart, is sufficient. Treatment of pole butts for 8 ft. by boiling in creosote, which is allowed to cool before the poles are removed, has been found advantageous and gives about fifteen years of life.

The overhead construction in the electrified territory (438 miles) is maintained by a force of three crews located at different points on the line and provided with work trains. There are ten men in each crew as follows: One foreman, three linemen, one groundman, one engineman, one fireman, one conductor and two brakemen. Two men are assigned to the testing of rail bonds. The regular maintenance and renewal of bonds is taken care of by the track section gang.

In general the construction of the distribution line does not differ materially from that of other direct current electric traction and trolley lines aside from certain special features, as follows: (a) The catenary construction, with two trolley wires hanging side by side and supported by messengers. (b) The higher direct-current voltage. (c) The joint use of ground wire and supplemental return circuit.

The committee goes into the details of the locomotive and signal systems, largely by way of description. On the latter subject the report says that the type of trolley pole construction used prohibited the use of upper or lower right-hand quadrant semaphore signals, as either of these types would have been obstructed from view by the poles. It was necessary, therefore, to install either upper or lower left-hand quadrant signals or light signals. The latter were installed.

Comparing the initial cost of the alternating-current signals, as installed here, the cost of these was said to exceed an equivalent signal installation of direct current by approximately 35 per cent when the overhead structure is available for support of the necessary signal conductors. In general the operation cost will be considerably less in an a.c. signal installation due to the lower power cost. Climatic and other conditions being favorable, the simplicity in the apparatus of an a.c. signal system, particularly with the light type of signal, permits assigning much longer sections to a given maintenance force than is possible with d.c. systems.

As to interference between the propulsion current and communication circuits the committee reported that there has been no marked interference in the talking system. The engineers of the American Telephone & Telegraph Company had made some study on the ground and found slight interferences from so-called tooth ripples of some 1,300 cycles. Experiments have indicated that the installation of resonant shunts in the substations will remove the trouble.

As for the accident phase of the St. Paul installation, it was stated that one employee had been killed through disobedience of orders. No passengers had been killed, but some trespassers had met with accidents due to attempting to ride on top of the locomotives.

No particular changes were necessary on account of the introduction of electrification in the arrangement of buildings or tracks, but the fact that two electric locomotives could handle a 2,800-ton train necessitated the lengthening of all the passing tracks to 1,000 ft. each.

Keeping Down the Load Peaks Automatically

Under the terms of its contract with the Montana Power Company the railway considered it necessary to install a power indicating and limiting system in order automatically to prevent excessive peak demands for power and as a guide for the train dispatcher. This system is in operation over the 220 miles of the Rocky

TABLE I—COMPARISON STEAM AND ELECTRIC OPERATION — FREIGHT

	October		November		December		Total	
	Steam	Electric	Steam	Electric	Steam	Electric	Steam	Electric
1,000 ton-miles	98,512	125,522	93,228	130,848	91,122	107,717	282,862	364,087
Train-miles	60,666	65,400	58,014	63,299	58,257	57,311	176,937	186,010
Ton-miles per train-mile	1,625	1,920	1,605	2,070	1,563	1,880	1,600	1,960
Total time, hours	6,094	5,022	5,946	5,084	5,785	4,429	17,825	14,535
Number of trains	535	585	523	583	526	543	1,584	1,711
Hours per train	11.29	8.59	11.26	8.72	10.99	8.16	11.25	8.50
Minutes per 1,000 ton-miles	3.70	2.40	3.83	2.23	3.81	2.47	3.78	2.39

Mountain division, where there are five feeding-in points with the Montana Power Company.

This system was designed and installed to accomplish the following results: (1) Indicate the total power. (2) Record the total power on a curve-drawing meter. (3) Automatically take care of certain power returned to the power company's line due to the regenerative braking features on the locomotives. (4) Protect each substation against excessive overload. (5) Limit the total power demand on the power company to an adjustable predetermined amount. (6) Reduce the direct-current voltage of the substation when the load exceeds the peak limit decided upon, affecting first the substation with the greatest load, then those with less load. (7) Provide manual means by which the total resistance of the pilot-wire circuit can be easily and instantly adjusted at the dispatcher's office to compensate for the variations in resistance due to temperature changes. (8) Accomplish the purposes outlined above with power supplied to the railway's 100,000-volt transmission lines at five feeding-in points distributed along the 220-mile division.[2]

The committee reported as to certain modifications which had been made in the load-limiting system, which as yet was in operation only on the Rocky Mountain division. The system was put in operation in July, 1918, with a kilowatt setting of approximately 12,000. On April 1, 1919, this was increased to 14,000 kw. Without the limiting feature of the power indicating and limiting system the demand would probably run to not less than 20,000 kw.

A chart showing the power required for trains of different tonnages at all points in the district is posted in the train dispatcher's office to enable him to become familiar with the loads, so that he can handle them promptly and provide the proper intervals between trains, so as to avoid bringing the power-limiting features into play. The higher the power-limiting feature is set the easier it is to dispatch trains, but the power costs are correspondingly increased. With a little study of train operation and a little practice the dispatchers are able to adjust the train movements to the needs of the service.

Under the subject of comparative operating results the committee quoted from a paper by R. Beeuwkes, electrical engineer of the railway, read before the New York Railroad Club, March, 1917.[3]

Table I was reproduced in order to show the early effect of electric operation in the movement of freight. It was stated further that the same tonnage all over the Rocky Mountain division has required 22½ per cent fewer trains, 24½ per cent less average time per train has been consumed, and operating conditions have been improved, so that nearly 30 per cent more tonnage can be handled by electric operation in about 80 per cent of the time formerly required to handle the lesser tonnage by steam. This means a valuable increase in the single-track capacity of the line.

As for comparative operating expenses, attention is called to the effect of the war at this point and the very considerable correction necessary to bring steam expense prior to Jan. 1, 1917, to a proper basis of comparison with electric operation expense. Table II was, however, compiled from the annual operating statements to serve as a guide.

The committee reported that in the opinion of the roadmasters and superintendents on the electrified zone there is no more slipping of the locomotive wheels on the rail and consequently no more damage to the top of the rail under electric operation than there is with steam locomotives. There is no greater tendency for the rails to creep under regenerative braking, nor have the electric locomotives moving at a high speed tended to displace the rail on the ties or the ties in the ballast. Roadmasters agree that the electric locomotive is easier on the track than the steam locomotive because of the less rigid construction. The flange wear on curves is less, also. From figures given some years ago by Mr. Beeuwkes, it was estimated that one kilowatt-hour measured at the low-tension side of the transformer in the substations is equivalent to 7 lb. of coal on the tender of a steam locomotive.

[2]Details of this system will be given in an early issue of the ELECTRIC RAILWAY JOURNAL.—EDS.

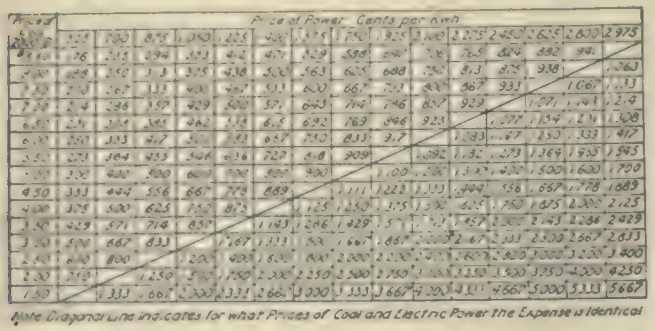
[3]See issue of ELECTRIC RAILWAY JOURNAL for March 24, 1917, p. 540.

TABLE II—ELECTRICAL OPERATING COSTS
From Annual Reports to Stockholders

	1917 12 Months	1918 12 Months	Averages per Year 1917 and 1918
Maintenance of way and structures:			
Power substation buildings	$ 468.64	$ 622.38	$39.00 per substation
Power transmission systems	1,000.68	4,265.44	$7.10 per mile transportation line
Power distribution systems	81,944.74	73,277.70	$134.00 per mile track
Power lines poles and fixtures	14,572.92	20,810.72	$40.20 per route-mile (440)
Maintenance of equipment:			
Power substation apparatus	$10,034.37	$25,914.23	$1,284 per substation
Other locomotive repairs	220,525.76	236,906.35	0.1023 per locomotive-mile
Other locomotive depreciation	77,134.23	85,208.51	0.0363 per locomotive-mile
Transportation:			
*Yard switching power produced	$ 233.83	.....	.....
*Train power produced	49,402.15	$94,580.46	$5,151.00 per substation
Yard switching power purchased	8,321.86	12,230.88	.....
Train power purchased	544,224.25	683,997.96	.....
Yard motormen	$16,007.63	$23,084.87	.....
Train motormen	262,177.75	346,260.32	.....

*Sum of these two items represents mainly substation attendance.

The committee concluded this section of its report by the following statements regarding the utilization of water power for electric operation of other railroads: (1) Transmission of electric power at 100,000 volts, with 3,000 volts on the contact wire, is practicable and



Note Diagonal line indicates for what Prices of Coal and Electric Power the Expense is Identical

TABLE III—RATIO OF POWER EXPENSE TO FUEL EXPENSE FOR VARIOUS PRICES OF COAL AND ELECTRICAL ENERGY, BASED ON 1 KW.-HR. OF SUBSTATION INPUT BEING EQUIVALENT TO 7 LB. COAL ON TENDER OF STEAM LOCOMOTIVE

reliable for electric railroad service for 100 miles or more of single track. (2) Such a system of electric operation will increase the capacity of a railroad from 25 to 35 per cent. (3) Such a system of electrification will probably prove economical as compared with steam operation, when the cost of reliable electric power and coal bear the relation to one another shown above the diagonal line in Table III, provided that the railroad traffic is favorable for electric operation. (4) The introduction of electric locomotives equipped with electric brakes has made possible the haulage of heavier trains at higher speeds on heavier grades, such as mountain divisions, and with greater safety and reliability under all climatic conditions.

SOME OTHER TOPICS DISCUSSED

Brief reports, in addition to the above, were made on the subjects of electrical interference and national safety codes.

On the first of these topics a committee, comprising A. H. Armstrong, chairman; H. K. Lowry, vice-chairman; R. H. Ford, J. B. Savage, M. Schreiber and F. E. Wynne, said that it had no record of existing interference of a serious nature with communication circuits by direct propulsion current carried through a third rail and track return. The interference caused by alternating current traversing an overhead trolley conductor with track return may be serious without the introduction of devices or measures which will minimize its magnitude. This may be caused partly by the static charge induced on neighboring conductors by reason of the high voltage usually employed, but is chiefly due to the magnetic effect of the current flowing in the trolley-track circuit. The most severe of these disturbances are set up at times of abnormal conditions, such as extreme overloads or short circuits.

Corrective measures and devices for alternating-current interference include: (1) Neutralizing transformers in telegraph circuits. (2) Combination of coils and condensers commonly known as "resonant shunts" in telegraph circuits. (3) Balance and insulation of telephone circuits. (4) Frequent transformer substations feeding trolleys and feeders in multiple. (5) Avoidance of stub-end feed. (6) Sectionalization of propulsion circuits. (7) Auto-transformer distribution system as installed on the New Haven Railroad. (8) Track booster transformers. (9) Current-limiting reactors. (10) Increase in the separation of telephone and telegraph wires from the propulsion circuits of the railway.

The committee quoted from an A. I. E. E. paper by H. S. Warren, of the A. T. & T. Co., to the effect that means are now known whereby alternating railway current can be kept sufficiently within control, except under abnormal conditions, to prevent substantial interference with neighboring communication lines, although there still remains the problem of obtaining a sufficient reduction of interference without incurring a cost which the railway companies consider excessive.

Interference by direct-current propulsion circuits may be occasioned by ripples caused by tooth harmonics, and a further source of disturbance may be the short circuits inevitable in electric railway practice. Tooth harmonics may be minimized and practically eliminated by proper machine design in new installations and by the introduction of resonant shunts in the substations of existing installations where tooth harmonics have caused appreciable effect on neighboring telephone circuits. The effect of short circuits may be greatly reduced by the introduction of high-speed circuit breakers.

Tests made on the C., M. & St. P. Ry. for the French Electrification Commission early in 1919 showed that there was no interference with the regular operation of the Helena-Spokane double multiplex printing telegraph circuits. The measures employed to minimize telephone and telegraph interference by direct propulsion current include: (1) The use of resonant shunts. (2) Design of generators to give negligible tooth harmonics. (3) Use of high-speed circuit breakers. (4) Reduction in the track-circuit voltage drop. (5) Balancing and insulation of telephone circuits. When such of the above means as are necessary are carefully applied no serious interference is noted.

Regarding the rules in the National Electrical Safety Code, it was suggested that in the matter of construction of galleries or rooms containing oil-filled transformers, etc., the rules should be worded to permit the construction of dams to confine the oil within small areas when no convenient means for drainage are available. Some detailed suggestions were also made regarding grounding rules and labeling of generators and motors.

A report was also made as to the getting together of the various interests with the United States Bureau of Standards in the American Engineering standards committee for the purpose of formulating consistent industrial safety codes.

A. I. E. E. Section Discusses Automatic Railway Substations

"Automatic Railway Substations" was the topic of the evening at the Feb. 27 meeting of the San Francisco Section American Institute of Electrical Engineers. The principal paper was presented by W. T. L'Hommedieu, Westinghouse Electric & Manufacturing Company. Discussion was presented by P. J. Ost, electrical engineer for the city of San Francisco, Walter Evans, electrical engineer of the Sacramento Northern Railway, and A. V. Thompson and O. E. Shreve of the General Electric Company.

The Safety Car Next Door to the North Pole

Experience at Levis, Que., During the Winter Just Closed Has Demonstrated That Climatic and Topographical Handicaps Do Not Put Light-Weight Cars Out of the Race

BY H. E. WEYMAN
Manager Levis County Railway, Levis, Que., Canada



ARRIVAL OF THE FIRST BIRNEY SAFETY CARS IN CANADA

SOME operators have believed that the lightweight safety car cannot be operated satisfactorily under extremely severe winter conditions. Actual demonstration, however, with a dozen Birney cars at Levis this past winter has demonstrated that this idea is false. The first instalment of our cars arrived early in September, 1919, and the remainder about the end of November. All of them have since been in service.

To enable the reader to understand the severe operating conditions in this locality it will be necessary to give some of its topographical and meteorological features.

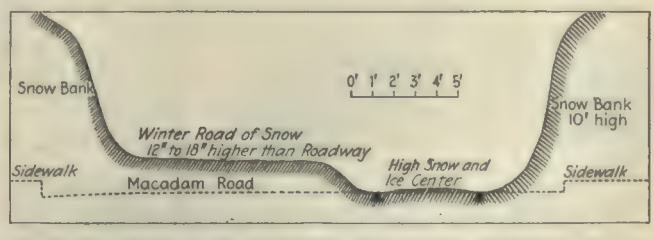
Levis and the adjoining municipalities which are served by this railway are situated on the south shore of the St. Lawrence River, Levis being opposite Quebec city and connected with it by a ferry line. This ferry is the only approach to Quebec from the south shore, for while the famous Quebec Bridge is in service only two or three trains pass over it each day and no provision is made for vehicles and pedestrians. Furthermore, the bridge is eight miles above Quebec, too far to be of service if facilities had been provided.

The severity of winter is much greater in Levis than in Quebec, which is protected by the heights to the north. On the other hand, Levis could not be more fully exposed, particularly because the valley between the Laurentian Mountains and the Island of Orleans forms a huge gully through which northeast and east winds sweep, hitting the land point at Levis. On a fine winter day, with a 30-mile west wind blowing, one finds Quebec city quite comfortable, while over at Levis a cloud of snow is driving down the streets, forming drifts from 3 to 10 ft. high. On a stormy day conditions in Quebec are bad enough, but across the river it is impossible even to face the storm and the houses are invisible from the center of the street. A double-broom sweeper may be passed over the track at one moment and five minutes thereafter the track may be buried under 5 ft. of snow.

The streets in this locality are very narrow, averaging 24 ft. between sidewalks, with some streets as narrow as 12 ft. Thus car tracks must be on one side of the street, and as no sidewalks are cleaned of snow a bank is formed on the sidewalk next to the track 5 to 10 ft. or more in height. This bank is responsible for much of the difficulty experienced in the operation of the railway.

IN WINTER AT LEAST THE RAILWAY MEN IN LEVIS EARN THEIR PAY

Levis is situated near the center of the "snow district" of Canada. Snow arrives to stay about Nov. 20, without fail, and remains until April. From November until March the sun is not powerful enough to melt the snow, so that whatever snow falls remains until March



CROSS-SECTION OF STREET SHOWING WINTER ROAD CONDITIONS IN LEVIS, QUE.

and disappears finally only at the end of April. In January and February, the months of heaviest snow, the average is 34 in. each, with a total snowfall for the winter of 140 in. This sometimes goes as high as 160 in.

Extreme cold is also experienced from November to March, but, provided the temperature is not much below zero and no heavy wind drifts the snow, the cold is of

advantage in operation, as it keeps the streets and tracks free of water and ice. The temperature from November until March averages below zero, and as a rule the changes in temperature are very sudden. The following table shows a meteorological record for a typical storm:

A TYPICAL STORM AT LEVIS, QUE

		Wind, Direction	Wind Velocity, m.p.h.	Temperature, Deg.
7.00 a.m.	Dull	N.E.	15	Zero
10.00 a.m.	Dull	N.E.	25	5
12.00 m.	Snow	N.E.	30	10
2.00 p.m.	Snow	N.E.	40	12
4.00 p.m.	Snow	N.E.	40	15
11.00 p.m.	Snow	N.E.	40	15
7.00 a.m.	Snow	N.E.	40	15
11.50 a.m.	Snow	N.E.	20	15
12.30 p.m.	Sun	N.W.	30	Zero
1.00 p.m.	Sun	N.W.	40	—5
2.00 p.m.	Sun	N.W.	40	—10
3.00 p.m.	Sun	N.W.	40	—10
6.00 p.m.	Sun	N.W.	20	—12
9.00 p.m.	Sun	N.W.	20	—15
11.00 p.m.	Sun	N.W.	20	—20
4.00 a.m.	Sun	N.W.	5	—25

Occasionally the temperature will rise to 25 deg. during a storm and two hours after the wind will change, the snow will stop and the temperature will drop to 15 deg. below zero. The table below is a record of what we have been through this winter:

WEATHER REPORT FOR WINTER OF 1919-1920

Date	Description	Wind, Direction	Wind Velocity, m.p.h.	Thermometer, Deg.
Dec. 14	Snow	E.	20	20
Dec. 15	Snow	E.	30	— 6
Dec. 16	Fine	N.W.	40	21
Dec. 17	Fine and drifting	N.W.	20	—30
Dec. 18	Fine and drifting	N.W.	40	—32
Dec. 19	Fine and cold	N.W.	10	—15
Dec. 20	Snow	E.	2	2
Dec. 21	Fine and cold	N.	15	—15
Dec. 22	Snow	N.E.	1	10
Dec. 23	Mild	S.W.	1	28
Dec. 24	Snow	S.E.	10	25
Dec. 25	Fine	W.	10	6
Dec. 26	Snow	N.E.	20	10
Dec. 27	Fine and mild	S.W.	10	25
Dec. 28	Snow	N.E.	20	— 3
Dec. 29	Fine and cold, drifting	N.	25	— 8
Dec. 30	Fine and cold, drifting	N.	28	— 6
Dec. 31	Dull and cold	N.E.	5	— 0
Jan. 1	Blizzard	N.E.	40	6
Jan. 2	Cold and drifting	N.	40	—15
Jan. 3	Cold and drifting	N.	35	—15
Jan. 4	Fine	N.W.	5	—10
Jan. 5	Fine and cold	N.W.	15	—18
Jan. 6	Snow	E.	5	10
Jan. 7	Snow	E.	2	20
Jan. 8	Snow	E.	5	25
Jan. 9	Fine	N.W.	15	8
Jan. 10	Fine	N.W.	10	0
Jan. 11	Snow	N.E.	2	18
Jan. 12	Fine	N.W.	10	— 6
Jan. 13	Fine and cold	N.	12	—10
Jan. 14	Snow	N.E.	6	—15
Jan. 15	Fine and cold	N.W.	15	—15
Jan. 16	Snow	N.E.	10	—12
Jan. 17	Blizzard	N.E.	35	2
Jan. 18	Cold and drifting	N.W.	45	—15
Jan. 19	Cold and drifting	N.	30	—30
Jan. 20	Fine and cold	N.	10	—25
Jan. 21	Heavy snow	E.	20	—15
Jan. 22	Fine and cold	N.W.	15	—10
Jan. 23	Snow	N.E.	10	— 5
Jan. 24	Cold and drifting	N.	40	—15
Jan. 25	Cold and drifting	N.	35	—15
Jan. 26	Cold and drifting	N.	10	—25
Jan. 27	Snow	S.E.	15	1
Jan. 28	Fine	S.W.	10	3
Jan. 29	Cold	S.W.	5	—10
Jan. 30	Snow and drifting	N.E.	30	—20
Jan. 31	Cold and drifting	N.	35	—35

It will be readily understood that the operation of a railway under conditions prevailing here requires the use of meteorological instruments and good judgment as to weather probabilities. If the snow sweepers go out a half hour late the cars will be stalled, and this in turn means more or less burnt-out equipment. On the occurrence of a blizzard failure to order the cars into the carhouses at the right time has the same result and seriously complicates the opening up of the railway after the blizzard is over. If passenger cars and sweepers try to fight their way back to the carhouses they leave bad rail for the plows to operate upon and much valuable time is lost and derailments are caused.

The snow at Levis is of a fine nature due to the cold, being similar to a good grade of table salt. Under wind pressure it will sift through even the smallest cracks. If equipment is left out the motors are filled with snow, and the drifting and sifting of snow of this kind at 10 deg. below zero produces one of the worst conditions of the rail under which cars must operate. Such are the conditions with which the safety cars have had to contend on this property.

An accompanying cross-section of a street in winter is given to enable the reader to visualize the operating conditions. There are no sidewalks in winter, because cleaning them would mean a very heavy expense to the taxpayer. The track is therefore used as a walkway, particularly after a storm. The railway has to cut the roads for the vehicles with plows and sweepers and the city of Levis and the other municipalities pay three-quarters of the cost of snow removal. Owing to the location of the tracks on one side of the street special snow-fighting machinery is used, including rotary plows. Nose plows are useless.

The snow-fighting work is done by men especially trained to handle the equipment and they must be on their machines as soon as the snow begins to fall.

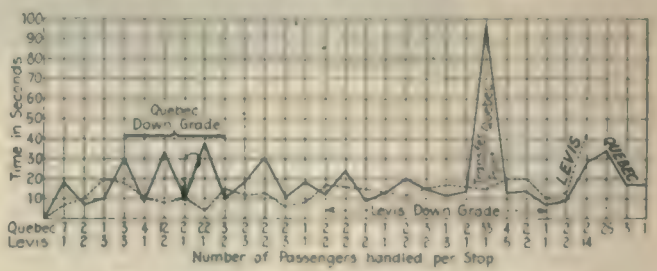


CHART SHOWING TIME IN SECONDS CONSUMED IN STOPPING AND STARTING CARS

Quebec Railway, Light, Heat & Power Company's double-truck car between Upper Town and Limoilou and return, round trip thirty-eight minutes. Birney safety car at Levis between Bienville Junction and uptown terminus, round trip twenty-six minutes. Both runs made during the winter of 1919-20.

Sweepers are first sent out, but if there is danger that the storm will become a blizzard all cars are ordered in. As soon as the storm shows signs of abating the rotary plows are put to work, each accompanied by a sweeper. As soon as the plows have completed their work and the track is swept the wing levelers are used, leveling off and pushing back the snow on the road. In some places the drifts have to be cut out by hand. It is urgent that this work be done before the temperature falls and the road traffic has much chance to harden the road. Otherwise the roads will build up several feet high, endangering road traffic and interfering with the operation of the sweepers.

After the roads are cut one of the rotary plows having a square nose and small extended wings is sent out to cut more of the banks on the sidewalk side. This is accompanied by a sweeper. This completes the operation unless the track centers are high, in which case a special ice cutter attached under a construction flat car is sent out, accompanied by a sweeper.

Few Cities Can Match These Operating Conditions

The Levis County Railway consists of 12 miles of single track with the usual turnouts or meeting points. It is divided into three divisions, one west 7½ miles, one

east 2¾ miles and one south, or Upper Town, 2½ miles, all radiating from the center of traffic at the Quebec Ferry. The eastern division is on 15-minute headway with three cars and three-quarters of an hour for the round trip. It takes care of the large drydocks and shipbuilding yards. There are four extras put on morning and night to take care of the workers on the docks, two of which go to Upper Town and two to Quebec Bridge.

The western division follows the river at the foot of the cliff, with many curves, but only two serious grades of 7½ per cent, 500 to 600 ft. long. It serves approximately 10,000 people and there are two fare zones on this line.

The eastern division serves 8,000 people about the docks already mentioned and has a very heavy grade of 13½ per cent for 400 ft. with two curves on it, and two other grades of 6 per cent 1,200 ft. long each. The track is largely tangent on this division.

The Upper Town division is nothing but grades and curves, the worst being 13½ per cent for 400 ft. with two curves and 11½ per cent for 1,200 ft., also with two curves. This division rises 320 ft. in 2⅛ miles, the grade averaging 6 per cent. It serves 7,000 people.

Between the eastern division and Upper Town there is quite an interchange of traffic. The density of traffic is controlled by the ferry, which is on fifteen-minute schedule in summer and half-hour schedule in winter. There is thus a congestion every fifteen minutes in summer, intensified in winter by the longer headway. In winter 300 to 400 passengers have to be handled by the cars every half hour.

As early as 1916 the company decided to try out one-man car operation and converted an old single-truck car for this purpose. The success of this car was such that it was decided to apply the Birney type of car, especially fitted up for Canadian climate. The difference from the usual standard features was as follows:

Car Body	Double-lined throughout. Double floor. Storm windows or sashes on all windows. Ventilators capable of being closed as required. All vestibule windows permanently fixed except center window being drop sash.















No. 1—Uptown terminus, Levis, at the peak of a cold wave. Note windows partly frosted.
No. 2—Wolf Street uptown, Levis. 10 deg. below zero and 40-mile wind.
No. 3—Point Levi. A Birney in the snow.
No. 4—In Hudlow Cove near Levis.
No. 5—Point Levi, one mile from ferry, Quebec Bridge division. Note snowbank at top of cliff ready to slide down.
No. 6—In one of the river coves, Quebec Bridge division. Note height of winter snow road at left.
No. 7—Fraser Street uptown, just after storm. Rotary plow just passed, sweeper has to follow. Tracks only route for team.

Air Equipment	Especially installed with the proper amount of radiating pipe to prevent freezing of air and moisture accumulation from the cold.
Motors, GE-258	To have covers for closing up the ventilating ducts in winter to prevent snow accumulation inside.
Trucks	26-in. wheels to give maximum clearance on account of high centers, due to snow and ice.
Heaters	12 single coil heaters.

These cars were highly satisfactory. It was found, however, that the motor drain holes had to be covered up and some other minor details required attention.

THE SAFETIES QUICKLY ADAPTED THEMSELVES TO CONDITIONS

When the safety cars were installed they had to face not only the weather conditions already described, but also heavy congestion at the ferry, which had caused the double-truck cars to be full to overflowing. The first three new cars placed in service on the Upper Town line early in September replaced four old single-truck two-man cars. They ran on the same headway, but were only allowed three-quarters of an hour for the round trip. The new cars made good from the start, producing a 30-per cent increase in traffic.

When the ferry service went to half-hour headway on Nov. 25 the traffic still held up and the cars were considerably overloaded in the rush hours, running from eighty-eight to ninety-three passengers each, all going up hill. Two extra Birneys were put on during the rush hours, running as double-headers, and even then both cars carried many straphangers.

The remaining eight cars arrived early in December and three were used to replace three double-truck cars on the Quebec Bridge division under the same operating conditions, the former double-truck cars having been operated by one man each. The new cars were able to handle the traffic except in rush hours, when two extra Birneys were put on with a turnback at the three-mile point. This gave double-headers every half hour from the ferry, which handled the traffic nicely, although it had taxed the capacity of the double-truck cars. The public has been much pleased with the change. This is a suburban traffic and no increase was looked for, but a slight one has resulted. The snow conditions on this line are severe, but the new car has proved equal to them. It must be understood, however, that the cars are not allowed to buck snow, because we have found that it pays to let snow-fighting equipment do this and save the passenger equipment.

The eastern division is still being operated with old converted one-man cars, much to the disgust of the public. When new cars are put on this division they will certainly bring a 30 per cent increase in traffic because the traffic density is greatest here. Snow conditions are better on this line than on the others. The dock workers here are handled by means of the discarded one-man cars.

A comparison test has just been made between a double-truck open-platform P.A.Y.E. car of the latest type, but without folding doors and steps, used on the



ROUTE OF THE LEVIS COUNTY RAILWAY AND OTHER LINES

Limoilou division in Quebec City and the Birney car on the Upper Town line in Levis, to show the time consumed per stop. Omitting passengers who boarded or alighted from the Quebec car while it was in motion, the time taken per passenger to alight was practically the same in the two cases. The time taken in boarding per passenger was two seconds greater for Levis, which can be explained by the large platform of the Quebec car and the fact that the car can be in motion before the passengers have paid their fare. However, the more rapid acceleration and braking on the Levis car made up for this difference. The graph on page 700 illustrates this comparison.

In this study stops or traffic holdups are not included. Attention is directed to the fact that the grades encountered by the Levis car are much greater than those in Quebec.

VERY FEW MAINTENANCE DIFFICULTIES HAVE BEEN EXPERIENCED

The Levis safety cars have been operated all during the past winter without any snow scrapers or flangers, but a small light scraper would be of some benefit and would not overload the motors any more than would 6 in. or more of snow on the rail.

We have found one unavoidable trouble with all types of cars in that the passengers bring in a lot of snow on their feet, which melts and keeps the floor wet. This water has percolated into the sand traps and register foot valves, interfering with their operation. The sand-trap trouble has been remedied, but the air-register foot valves will have to be relocated and improved. The water seeps down into the valves and freezes up, putting the whole air system out of commission.

There is no doubt that the additional equipment of the Birney car increases maintenance, but this is more than offset in other ways. Executives must remember that additional equipment requires care and must make the necessary allowances. All around, however, the maintenance on the safety cars compares favorably with that on the old cars, provided they are not neglected.

I have said nothing so far about accidents. We have had a few collisions. In a head-on collision between two Birney cars, in which one was making 12 m.p.h. and the other had started to back up at 2 m.p.h., the shock was taken at the buffer beams, which were not damaged. The main quarter-elliptic spring truck bolt was sheared clean off, the shock evidently passing right through the underframe of the car to the truck. Another head-on collision occurred between a Birney and an old single-truck car with 33-in. wheels, the buffer beam of the old car being almost on the level with the headlight of the Birney. The vestibule of the Birney was smashed in, but the repairs cost only $35.50, for when the sheathing was passed through a set of rollers it was as good as new. The heaviest cost was for painting. In collisions with vehicles the buffer beam has taken the brunt of the blow, one or two having been bent. The buffer beams held up just as well as those on the old type of car.

With regard to the interior seating arrangement, we use the cross seats all the way to the front. It has been suggested that the two front cross seats should be removed and short longitudinal seats installed, forming a well for standing passengers. Our experience indicates that it is easier to get the patrons to go to the rear when the cross seats are used in the front than when there is a well, because the operator can see better whether there is room at the rear and can urge his passengers to go back. The Levis cars are for double-end operation and are so wired that the car cannot move unless the proper trolley pole is on the wire. These cars were the first to be wired in this way.

Swiss Install Automatic Substation

Brown-Boveri Substation Operates by Clockwork of Simple Construction, but Does Emergency Switching Automatically

THAT the automatic substation has invaded continental Europe is indicated by Brown, Boveri & Company in their December, 1919, *Mitteilungen*. The automatic features are, however, not the same as those employed in this country where the station is caused to operate and furnish power intermittently as may be required by load variations. The Swiss station is operated by clockwork, which causes it to start at a given time and operate continuously until another given time, when the clock mechanism stops it.

Stephen Q. Hayes, switchboard engineering department, Westinghouse Electric & Manufacturing Company, mentioned this substation at the Pittsburgh meeting of the American Institute of Electrical Engineers. He has since furnished the ELECTRIC RAILWAY JOURNAL with the following abstract of the description of this substation, which appeared in the B., B. & Co. publication:

Full automatic installations of machinery are now recognized more and more as being necessary for many kinds of installations to secure economical and advantageous operating conditions. The increase in wages of labor, together with the shorter hours that labor works, has increased considerably the expenses of operation and maintenance. For these reasons it is desirable that future small, separately located substations, for which steady and dependable labor is difficult to secure, should be made automatic. These are principally rotary converter stations for tramway, railway or factory operation. Standard transformer stations as a rule require less superintendence and do not need constant inspection.

Brown, Boveri & Company, recognizing the future importance of automatic substations, have for some time studied such installations and have conducted experiments with a full automatic rotary converter substation with satisfactory results. Such a station is in operation at Riehen, near Basle, in Switzerland, and serves as a feeder for the Basle-Lorrach Railway. This is, so far as we know, the first automatic rotary converter substation on the old continent, although in America during the last few years substations have been erected. However, they operate on a different principle than that employed by the Brown-Boveri Company.

The functions of the automatic substation at Riehen consist of automatic starting in the morning and automatic shutting down in the evening, as well as temporary opening and reclosing in case of temporary open circuit in the source of supply or overload or short circuit on the direct-current end. Furthermore, in case of a period of long duration of open circuit of the source of supply an alarm is given at the central point regarding the interruption of power. The different combinations for securing these results are secured in our equipment by a combination of relays and contactors which control different switches. The automatic starting in the morning and automatic shutting down in the evening are accomplished by a time-clock of simple construction.

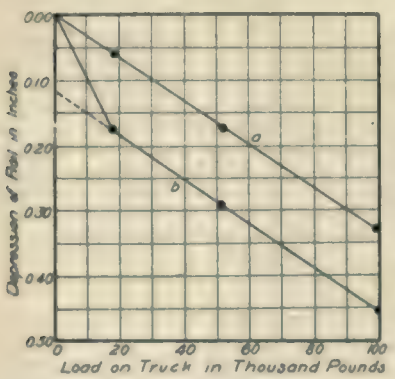
With the Brown-Boveri system present substations can quickly be changed over to the automatic type without interrupting the operation of the system during the change-over. Naturally, such changing over of old installations requires that a part of the old apparatus must be changed or replaced by new. Even then the automatic substation pays for itself after making an allowance for cost of new apparatus plus 15 per cent for insurance and depreciation. Still more economical is the up-keep of new installations, where original costs are almost the same as for substations with attendants.

Stresses in Railway Track Analyzed

Report of Joint A. R. E. A. and A. S. C. E. Committee Deals With Tie Bending as Related to Tamping and With Distribution of Ballast Pressure

IMPORTANT data applicable to electric railway track and forming a valuable addition to existing knowledge on track mechanics are included in the second progress report of the American Railway Engineering Association's committee on stresses in railway track, presented at the recent convention in Chicago. This was a joint committee with the American Society of Civil Engineers.

The first report of the committee, presented in March, 1918, recorded the following conclusions: The stress in the rail under a train or any other load is determined by the general track depression, with little regard to tie spacing. The roadbed acts as an elastic structure except for certain looseness or play absorbed in the first stage of the depression. Heavy rail, hard ballast and deep ballast make stronger track by reducing the track depression. Thorough tamping of track also reduces depression and rail stress. It was also found that a train produces larger stresses when running at speed than when standing, and although the increase could not then be measured satisfactorily, it would seem to be of considerable amount. Transverse bending of the rails was observed, arising from conditions not fully explained; in some cases the ratio of stress in outer flange of the rail base to stress in inner flange is greater than 3 to 1.



TYPICAL LOAD DEPRESSION DIAGRAM. (a) TRACK IN BEST CONDITION, (b) SPACE OR PLAY UNDER TIE

The investigations covered by the second report indicate that:

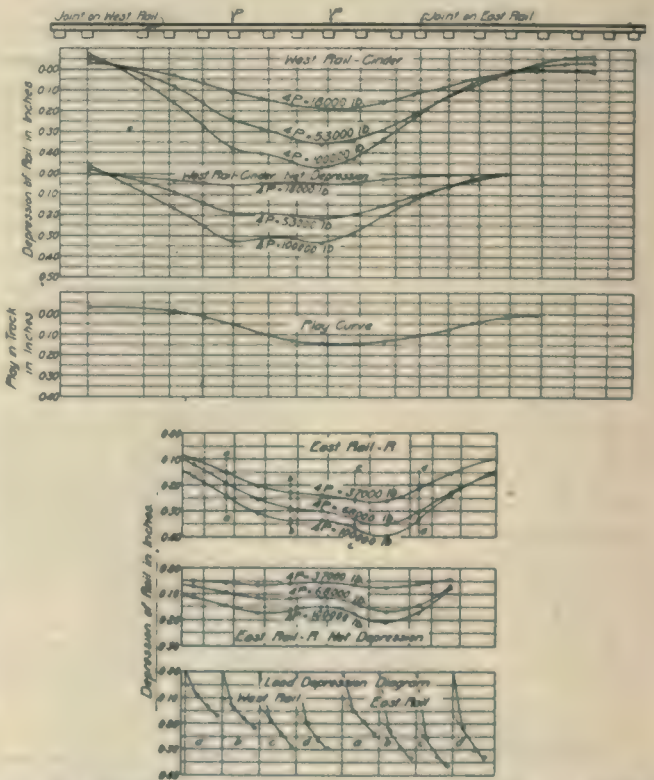
(1) There is a large speed effect. This is roughly proportional to the speed and may equal or exceed one-half the static stress.

(2) Wheel loads are distributed to the several ties in the same ratio for large as for small loads. The depression of any tie is proportional to its load, except that there is an initial irregularity of deflection chargeable to soft bearing or to slight play between rail and ballast. The maximum tie reaction under a four-wheel truck ranges from 13 to 16 per cent of the truck load, agreeing with theory.

(3) Most track is distinctly center-bound before tamping. The endbound condition produced by tamping rapidly disappears, but the bending moment in the tie is greater directly under the rail than at mid-length. The critical bending moments in the tie range from 2 to 6 lb.-in. per pound of tie load, but should not exceed 2 to 2½ for first-class track well maintained.

(4) Transmission of pressure in ballast follows laws deductible from theoretical considerations. At any level below the tie the lateral distribution of load follows the "error curve." In this respect sand, gravel and broken-stone ballast behave alike. The pressure decreases downward according to an exponential or logarithmic law. The pressure of tie on ballast is greater at the middle of the width of the tie and least at the edges, due to the friction between ballast and tie, as the ballast tends to flow out laterally.

(5) About 4 in. below the tie the ballast pressure is equal to or greater than that just at the tie. At 6 in. depth the load begins to spread, and at a depth equal to the tie spacing the pressure is nearly uniformly distributed.



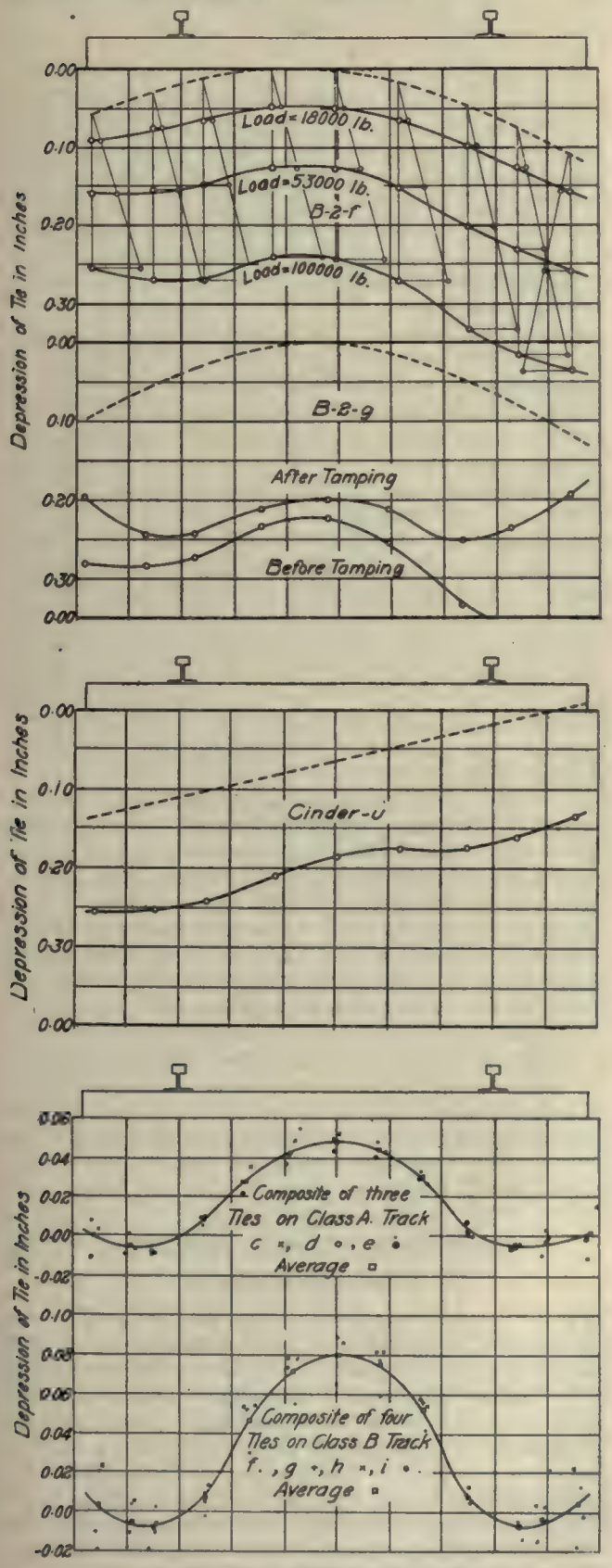
TRACK DEPRESSION PROFILES. LOAD APPLIED TO FOUR-WHEEL TRUCK AT ONE END OF CAR. WHEEL BASE 5 FT. 6 IN. (UPPER DIAGRAMS) SAWED OAK TIES, CINDER BALLAST, 85-LB. RAIL. (LOWER DIAGRAMS) HEWN SOFT WOOD TIES, GRAVEL BALLAST, 75-LB. RAIL

Distribution of Load to Ties

New measurements of track depressions under known loads not only confirmed the former deduction that track is elastic but also provided data for computing the load on the individual ties.

A leveling bar was used to measure the depressions and plots were made of depressions under a four-wheel truck loaded to different total loads. When the depressions at any one point were plotted on a base of load a straight line resulted, demonstrating elastic action, but in the early stage of the depressions there was a divergence from the straight line, indicating the equivalent

of a slight looseness or play in the track before solid bearing was reached and elastic action began. Taking from these plots the amounts of play for different points along the track a play curve was obtained. Deducting the amounts of play from the depressions curves of net or elastic depression were obtained.



TYPICAL TIE FLEXURE DIAGRAMS

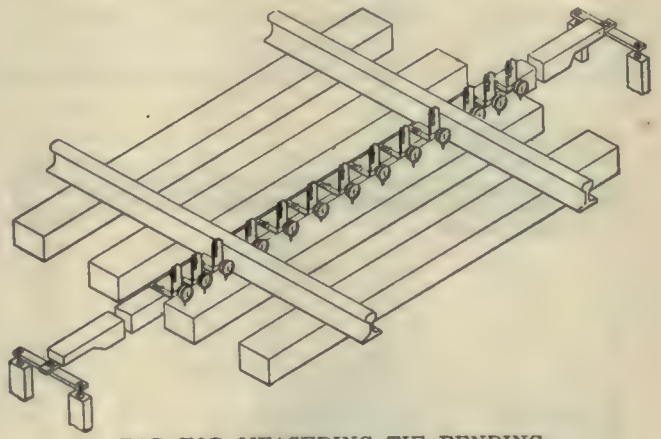
From such net curves the depressions of all the ties affected were summed and equated to a total load. Simple division thus yielded the value of load required to depress one tie one inch, and this value multiplied by the depressions of the individual ties gave the loads borne by them. The load on a tie directly under an axle generally amounted to 13 to 16 per cent of the two-axle truck load; midway between wheels the tie reaction was as much as 1½ per cent more.

TIE REACTIONS IN TERMS OF LOAD ON FOUR-WHEEL TRUCK

(Typical results of tests for 7 x 8-in. ties on 36-in. gravel ballast. First three lines refer to main-line track with 100-lb. rail; last two lines to branch-line track with 75-lb. rail.)

Tie 1	Tie 2	Tie 3	Tie 4 (Under Wheel)	Tie 5	Tie 6	Tie 7 (Under Wheel)	Tie 8	Tie 9	Tie 10
0 08	0.09	0.10	0.11	0.11	0.10	0.11	0.11	0.10	0.07
0 04	0.08	0.11	0.13	0.13	0.13	0.12	0 12	0.09	0.05
0 03	0 07	0 11	0.15	0.15	0.15	0.14	0.11	0.07	0.02
0 06	0.08	0.10	0.10	0 10	0.11	0.14	0.13	0.10	0.07
0 06	0 09	0.13	0.14	0.13	0.13	0.12	0.10	0.06	0.03

Measurements of the flexure of the tie were considered the best means of studying tie action. A gage bar was supported on stakes at either side of the track



BAR FOR MEASURING TIE BENDING

and thirteen Ames dials attached to the bar bore each on a line at the middle of the width of the tie. A two-axle truck with 18,000 to 100,000-lb. load was placed on the track so that the leading axle was directly over the tie under test. The ties sawed ranged from 7 in. x 8 in. x 8½ ft. to 6 in. x 8 in. x 8 ft.

Many curves of tie flexure were obtained, of which an accompanying illustration gives examples. The upper part of the upper diagram shows how the several bending curves on any given tie were utilized for determining the "play" or looseness of the tie. At various points along the bending curve the loads for the respective curves were plotted as abscissas, with the deflections as ordinates, and load-deflection curves were drawn as straight lines through the resulting points; the zero points of these load-deflection lines were taken to represent the initial solid bearing. By this means the dotted lines shown in the illustration above the observed tie-flexure curves were obtained, these dotted lines representing in effect the profile of the tie at the moment it reached solid bearing.

Net deflections, reckoned from the curves of solid bearing, were plotted in the two composite tie-flexure curves constituting the lower diagram of the same illustration. It will be seen that the net deflections showed fairly similar action in different ties, although the gross deflections varied greatly.

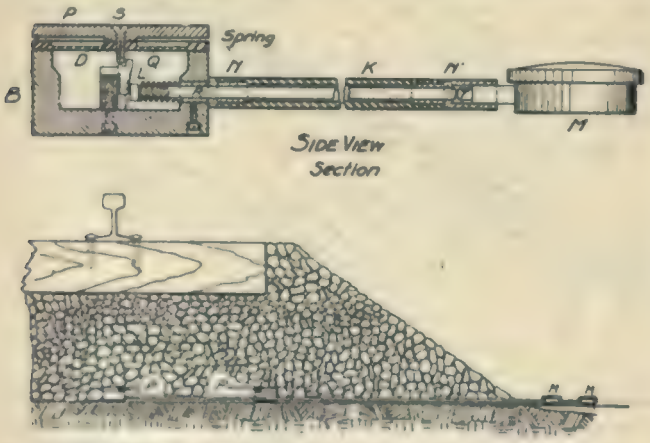
From the flexure curves the bending moments in the ties were computed, based on average moduli of elasticity found by bending tests of ties in a testing machine (oak ties, 1,250,000 lb. per square inch; soft wood ties, 800,000 lb. per square inch). The committee concluded that in first-class track a center moment of 2 *W* and a reverse moment at the center of 1 *W* is to be expected, and a moment under the rail of 2.5 *W*.

Comparing the bending moments with those which would result from various distributions of bearing pressure on the lower face of the tie, the committee concludes that "the maximum bearing pressure per unit of length of tie under static loading will not ordinarily exceed twice the average bearing pressure over the length of the tie, and for track in good condition the maximum will be less than one and one-half times the average."

PRESSURES IN BALLAST

To measure the pressure in the ballast at various depths below the tie special gages were constructed. In the gage the deflection of a steel diaphragm plate protected by a faceplate is measured by a small lever whose motion is transmitted to the plunger of an indicating-dial micrometer. The faceplate has an exposed area of 5 sq.in.

The test rig consisted of a reinforced concrete slab



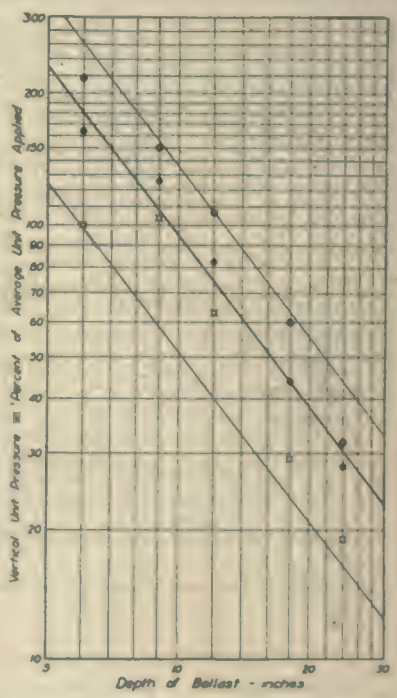
PRESSURE CAPSULE AND LOCATION IN BALLAST

16 ft. x 19 ft. x 12 in. thick, on which the ballast was carried, and over this slab a reaction frame was anchored to it by tie rods to serve as abutment for a jack by which loads could be applied to one or more ties resting on the ballast. The jack load was measured by a calibrated steel spring. Measured pressure obtained with this apparatus confirmed the deduction that at any horizontal plane in the ballast the vertical pressures are distributed laterally in proportion to the ordinates of a probability or error curve, which curve spreads out wider and has a lower middle ordinate as the depth below the concentrated load is increased.

From a single-tie test it was found that the distribution of pressure laterally followed a law very similar to the probability law. This pressure distribution flattens out with increasing depths below the tie. The effect of several ties whose zones of influence overlap is in close agreement with a curve obtained by adding the separate effects of the individual ties. In stone ballast the pressure distribution is somewhat less regular than in fine ballast, but the same general laws are evidently effective for both types of construction.

The committee concludes that "the laws of distribution of pressure through ballast are practically the same for the various kinds of ballast." From contours of equal vertical unit pressures in ballast it is concluded that "in general the vertical pressures become nearly constant at a depth equal to the tie spacing."

In regard to the effect of friction between the bottom of the tie and the ballast, tending to crowd out from under the tie, it was concluded that "there is a concentration of pressure a short distance below the tie, say at 3 to 4 in., and the intensity of pressure in the ballast at such a depth is greater than exists at the bottom of the tie. For the tie of ordinary width the intensity of pressure at a depth of 6 in. and the distribution of vertical pressure over a horizontal plane at this depth do not differ greatly from those existing immediately under the tie. The directions of the pressure are not the same. At or below this depth the distribution of pressure laterally begins."



VARIATION OF BALLAST PRESSURE WITH DEPTH

Also, the committee says "for the ordinary width of tie the effect of the pressure transmitted from the adjacent tie to points midway between ties is noticeable at a depth equal to about half of the usual tie spacing. At a depth of three-fourths of the ordinary tie spacing the pressure immediately under the center of the tie is about one and one-half times that resulting from a uniform distribution over the horizontal plane. At a depth equal to the ordinary tie spacing the lateral distribution has become such that the variation in intensity of pressure from tie to tie is small. The variation in intensity of pressure in the ballast lengthwise of the tie becomes less and less with increase in depth and it may be expected that the variations will be smoothed out at a depth equal to the ordinary tie spacing or a few inches below, where there will be a fairly uniform pressure over the horizontal plane."

New Signal Service on Boston Elevated Railway

PLANS have been prepared by the Boston Elevated Railway Company for the installation of a new signal service on a portion of the rapid-transit lines. It is planned to install a three-light system on about 1.14 miles of line in the Washington Street subway, in addition to installations at the north and south approaches. Under the new system there will be a total of thirty-three blocks equipped with these signals, operating under an alternating-current service, with the exception of the automatic stops, which will be of the pneumatic type of control.

Speeding Kansas City's Traffic

The Third Beeler Report Is Devoted to Main Street, the City's Greatest Traffic Artery—It Urges Island Platforms, More Extended Use of Prepayment and Some Rerouting—More Strict Regulation of Automobiles Also Recommended

THE third Beeler report on Kansas City, recently issued, is devoted largely to traffic conditions on Main Street. This street is the main artery for north and south traffic, and throughout the business district it is densely lined with retail stores and shops. It also forms the most direct connecting link between the business and hotel district and the new Union Station, through which all trains enter and leave the city.

The average width of the roadway through the congested section is 46 ft. Double tracks, 10 ft. center to center, occupy the middle of the street. The clearance between the street cars and the curbing is 13½ ft., which is more than sufficient for the passage of a single line of vehicles, but lacks by 1½ ft. to 2½ ft. enough clearance for a double row of vehicles, standing or moving.

Three important car lines run on Main Street for the greater part of its length and furnish service between the business section and the southern residential district. In addition, the Main Street tracks are used for several blocks by a number of other lines which turn onto or off between Fifth and Nineteenth Streets. The number of through cars scheduled both northbound and southbound on Main Street is but fifty-two, but this number is increased to ninety-two northbound between Ninth and Tenth and to sixty-two southbound between Eighteenth and Nineteenth.

Twelfth Street is the heavy intersection with 183 cars an hour scheduled to go through during the rush. Other busy intersections are scheduled to pass 161 cars, 144 cars and 132 cars respectively during the same period.

The improvements suggested in the previous reports have been effective in bettering car operation. A total of forty-nine more cars are now passed through the intersection of Main and Twelfth Streets during the rush hour, or more by 40 per cent, than were passed previously. Nevertheless, the intersection is still vacant practically 60 per cent of the time as far as car movements are concerned. Double-berthing, according to Mr. Beeler, has been a great factor for good. It is also a fact that by giving precedence to the street cars and by co-ordinating the movements of all other traffic with those of the street cars the traffic officers have been able to put all traffic through with greater dispatch. At other intersections, where there is much left-hand turning, rerouting is suggested.

Car Speeds on Main Street

From 5 to 6 p.m. the average speed of the cars on Main Street, southbound, or in the direction of the heaviest traffic, is but 5.83 m.p.h. all the way from Ninth to Twenty-fourth Street. From Ninth to Tenth Street it is 4.34 m.p.h. and from Tenth to Twelfth Street it drops to 2.51 m.p.h. Cars have been observed making less than 2 m.p.h. in this district.

At other points the speeds are low. The frequency of passenger and positive stops, the lack of double-berthing at heavy boarding points, and slow loading are all contributing factors to these abnormally slow car movements.



THIS CHART SHOWS HOW PARKED VEHICLES BLOCK TRAFFIC IN KANSAS CITY'S BUSINESS DISTRICT. THIS COUNT REPRESENTS CONDITIONS AT 2 P. M. ON NOV. 15, 1919

The amount of vehicular traffic on Main Street is illustrated by a count made at the principal intersection, Twelfth Street, on Nov. 15, 1919. Between 4:45 and 6:15 p.m. on that day 736 vehicles, one-fourth of which were jitneys, passed either north or south on Main Street, while 245 passed east or west on Twelfth Street. On Nov. 20 a count between 4 p.m. and 6 p.m. showed the following division of traffic:

Type	Number	Per Cent
Automobiles	795	58
Jitneys	324	24
Trucks	224	16
Wagons	20	2
Total	1,363	100

A vehicular passenger count showed that the 795 passenger automobiles carried 1,547 persons including driver or an average of 1.9 persons per car. The 324 jitneys transported 1,349 passengers or an average of but 4.2 per vehicle not including the driver. The small number of people transported by each jitney, and the consequent high ratio of man-power employed, 1 to 4.2, according to Mr. Beeler, shows the extremely wasteful methods required by this form of transportation. Additional street cars at the rate of only nine per hour would have cared for this number of patrons. This would save the necessity of passing 324 jitneys over this crowded thoroughfare and through its congested intersections, thus reducing the vehicular traffic movements 24 per cent. The fact that the private automobile carries less than two persons per car shows the necessity of giving the street cars precedence if the people are to be transported expeditiously.

Two charts were prepared, of which one is reproduced showing typical morning and afternoon parking conditions in the business district. They demonstrate that all streets in the business section are used extensively for parking purposes throughout the entire day. During the rush hours, especially the evening rush, conditions are still further aggravated by the jitneys and the automobiles which enter the business district and sometimes even park in double rows while waiting for passengers.

Mr. Beeler declared that this parking interfered greatly with rapid car movement in numerous ways, as it prevented the cars from pulling into the berths, hampered car movements, bunched the cars and filled the streets with waiting patrons. This prevents traffic officers from properly co-ordinating the movements of vehicles with those of the street cars, which is the secret of expediting traffic movements.

Measures for Relief Recommended

In addition to employing the measures previously recommended, such as restricting the number of stops in the congested district, giving precedence to street cars, double-berthing, limiting parking and keeping vehicles off the car tracks, Mr. Beeler recommended the following:

1. Use raised loading platforms in the streets at the most important passenger stops in the congested district.

2. Prohibit jitneys from using Main Street within the congested district.

3. Employ prepayment method of fare collection at Union Station Plaza.

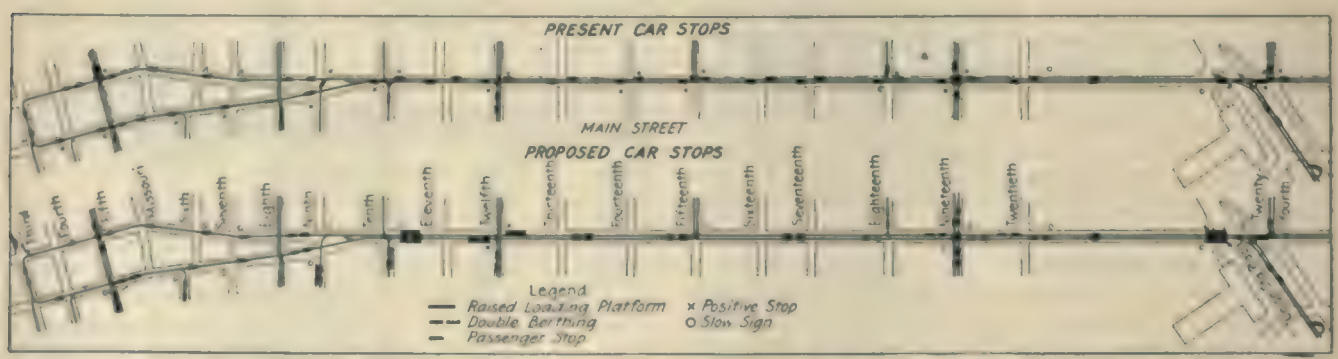
4. Reroute some of the car lines so as to reduce the number turning into and out of Main Street at congested points.

Loading Platforms to Be Installed

The loading platforms recommended by Mr. Beeler and subsequently built were installed at three passenger stops northbound on Main Street, three southbound on Main Street, one eastbound on Tenth Street and one westbound on Ninth Street.

The platforms recommended were to be approximately 100 ft. long, 4 ft. 6 in. wide, and 9 in. above the top of the rail in height, and the inside edge was to be 26 in. from outer rail. This would allow a space 9 ft. wide for vehicular traffic between the platform and the street curb. As laid out, these loading platforms occupy what was actually waste space in the roadway.

Mr. Beeler believed that these platforms, by concentrating the passengers just opposite the car entrances, would materially assist in quickly loading the cars and thus speed up the car movements. He also recommended that vehicles should not be permitted to park at any time between the curb and loading platforms nor along the curb for a distance of 50 ft. from the end of any platform. Neither may vehicles use the car tracks at these points. A rigid enforcement of these rules, Mr. Beeler says, will reduce street accidents as well as increase the capacity of the streets very materially.



PRESENT AND PROPOSED CAR STOPS ON MAIN STREET. THE LOWER DRAWING ALSO SHOWS THE LOCATION OF THE PROPOSED ISLAND PLATFORMS

At present, in order to secure early relief, these platforms should be built of wood. Afterward they may be replaced with more permanent construction of stone and cement. At night they should be red-lighted at each end.

Banish Jitneys from Main Street

While the traffic from jitneys amounts to 25 per cent of the total vehicular movements on Main Street, their proportionate value as transportation carriers is so low that they should not be allowed to congest so important a thoroughfare, at least between Fifteenth and Eighth Streets. If jitney operation is considered necessary to supplement the street car service in Kansas City, Mr. Beeler says that their downtown operations should be confined to Grand Avenue, which is a wider street, and to Baltimore Avenue, which is free from car tracks.

It is recommended that the prepayment method of fare collection be employed at the Union Station passenger stop, at least in the northbound direction.

Prepayment is a great convenience to patrons, especially where such large numbers of strangers and others, mostly burdened with grips and parcels, board cars as they do here in the northbound direction. Southbound, the passengers are leaving the cars and comparatively few are boarding, consequently prepayment in this direction would be of little value. At other heavy loading points street collectors are recommended. Where used, standard cars should be loaded at the front end and safety cars at the rear end. Collectors should have a key by which they can open the rear door of the safety cars from the outside.

PARKING REGULATION

Strong emphasis is laid on the importance of a rigid enforcement of the anti-parking ordinances in view of the fact that the average auto transports less than two persons including the driver during the evening rush. "How long," Mr. Beeler asks, "will the taxpayers continue to provide $10,000 worth of improved street to park a vehicle that has an average transportation value of less than two persons per trip? Assuming every one in the business district used this method of transportation where would the automobiles be kept? A principle that must be adopted and adhered to is that the streets of the city are its arteries and must be reserved for moving traffic and not for storage purposes."

Electric Railway Notes from Italy

Electric Railway Expert Sizes Up the Present Situation with Regard to Heavy and Light Electric Traction

BY FERDINANDO C. CUSANI
Milan, Italy

ALTHOUGH the commission appointed by Minister of Transportation De Vito has not submitted as yet its decisions about the system of electric traction to be adopted for the 3,120 miles of Italian State Railways lines, which will have to be electrified in accordance with the decision of the Italian Parliament, the State Railways management is actively pushing the electrification of about 375 miles of track in the northwestern part of the country. The several routes connecting Turin with Genoa are being provided with aërial lines, power feeders and substations for a total of 250 miles. The work is being done directly by the electric traction service of the State Railways.

At the same time private contractors are equipping the Turin-Milan and Voghera-Milan lines, totaling 125 miles. Both of these groups of lines will be operated on the three-phase system, as they are simply links connecting the three existing groups of three-phase lines, namely, the Genoa-Riviera-Giovi tunnel group, the Modane-Frejus tunnel (Moncenis)-Bussoleno-Turin group, and the Monza-Lecco-Colico-Sondrio and Colico-Chiavenna (Valtellina) group. It is hoped that electric traction on these two projects will be started within this year, and in the meantime arrangements are being made with electric power companies to supply the railroads' demands.

Electric power companies of Central Italy (Aemilia, Tuscany and Umbria) have already arranged with the State Railways for the supplying of power for the electrification of the trunk lines crossing their zone. Two power stations, which will supply about 20,000 kw., and will burn lignite directly as it is brought out of the mines, will be erected at Tavernelle di Perugia and Torre del Lago. These stations have been planned in such a way that, as soon as the output of the lignite mines increases, their capacity will be augmented accordingly. It is the intention to use as much as possible of the lignite, which is a rather low-grade fuel, directly in specially designed boilers, where it can be much better utilized than under the present practice of mixing it with coal and burning it in locomotive fireboxes.

In this respect it is interesting to note that the State Railways, after very careful experiments, have decided to convert as many engines as possible from coal to crude-oil burning. The reason given is that, although both fuels have to be imported, it has been found that it costs much less to handle oil, which, although more costly at the point of origin, can be most easily transshipped from tank steamers to reservoirs ashore and from these, through pipe lines and tank cars, to the locomotives themselves. Moreover, the adoption of liquid fuel is certainly going to improve the conditions under which the locomotive crews are laboring in the south, especially during the torrid summer season, and to make working conditions less exacting on the mountain divisions.

As for the private railroad companies, it may be stated that although many projects of electrification have been started, they are generally lagging behind on account of the very difficult conditions of the materials market, and on account of the most prohibitive exchange rates, which positively enjoin the use of foreign materials and machinery.

NEW ELECTRIFICATION WILL PROBABLY BE 1,200-VOLT DIRECT CURRENT

The Torino-Ciriè-Lanzo Railway is being electrified, the contract having been awarded to a Swiss firm which has been hitherto known as the strongest advocate of three-phase traction. It is said that this line will operate on high-tension direct current at a voltage over 1,000 and, although this is an interurban line, according to the American point of view it is probable that locomotive operation will be resorted to.

Construction of the Rome-Ostia-Harbor of Rome electric high-speed line, which will be operated by the Rome Municipal Corporation, is being pushed forward, while at the same time the Roman Tramway & Omnibus Company, which has surrendered operation of all its city lines except two to the Municipal Corporation, has been reincorporated under the name of Italian Railways Company (Società Ferroviaria Italiana) and will engage in the construction and operation of an electric line from Civitavecchia to Orte and eventually to Terni, the steel city.

The Lombard Electric Traction Company (Società Trazione Elettrica Lombarda) has been definitely incorporated as the successor of the Italian Edison General Electric Company, and has already taken possession of the lines formerly operated by that company around Milan and of the lines which were controlled by that company. It has also acquired control, through ownership of a major part of the shares, of the Milan Northern Railways, and it appears that a merger will be made with the Brescia Electric Company (Società Elettrica Brescianna), operating some hundreds of kilometers of 1,200-volt direct-current interurban electric railways. This will mean that, apart from the city lines generally owned and operated by municipal cor-

porations, and from a few narrow-gage interurbans, all the electric railways not operated by the State Administration and all the steam tramways in Lombardy will be owned by this new corporation.

LARGE MILEAGE WILL BE ELECTRIFIED

It appears that electrification work and new electric construction planned by different private companies throughout Italy will amount to about 2,500 to 3,000 miles, thus bringing the total of planned electrification to more than 6,200 miles.

Electric street railways are laboring under very heavy difficulties just now, the most important one being the lack of rolling stock and the inability of local manufacturers, who are overburdened with repair and construction work for the State Railways, to supply even a small part of their requirements. And as similar conditions seem to prevail in other countries, no relief can be sought through the importation of rolling stock. The abnormally and unjustifiedly high exchange rate makes it almost impossible to think about ordering cars in the United States, although some companies appear to have given serious thought to the matter.

Owl service, which was hitherto unknown in this country, is being started in a number of cities. Beginning on Feb. 23, the Milan Corporation Tramways has been giving hourly service between 1 a.m. and 6 a.m. on twelve of its lines, giving access to all of the different sectons of the city. The rate is 1 lira per ride, that is four times the common fare (25 centessimi) and ten times the morning reduced fare (10 centessimi). Conductors of the owl cars on leaving the carhouses are each supplied with a regulation army revolver, which they have to turn in with the money collected when they reach the carhouses after 6 o'clock. It is hoped that the owl service will be appreciated by the public, the hack service having been seriously cut down during the war and taxicab service being both costly and uncertain due to the lack of gasoline. It appears that other cities will soon follow the lead of Milan in giving such service.

Recent Snows Shop Many Cars

THAT the snows of the past two months have placed an exceptionally heavy load on the repair shops in New England is shown by the Connecticut company's experience. For example, the records since Feb. 4 show that the minimum number of cars per day which have been in the repair shops has been ninety-one, and on many days the number has risen to as high as 110. These figures are for the lines centering at New Haven and operating with about 800 cars. Normally, not more than forty cars are in the shops.

There are two chief causes for these high numbers. One is that the icy nature of the snow and the impossibility of keeping sweepers going all the time were conducive to the formation of high ice centers, until many motors dragged on these high centers with consequent damage. The second difficulty which caused many failures was that there have been several periods of thaw with no possibility of the water running off to sewers. This has caused many wet motors and wet leads, which in turn have caused cars to go to repair shops.

The additional travel due to snow-blocked automobile roadways, all thrown on this reduced equipment along with the regular travel, would tax the energies of any operating force.

Why Do Car Fares Differ?

Cincinnati City Council Receives Report Shqwing Reasons for Difference in Cincinnati and Cleveland—Local and Contractual Conditions Affect Comparison of Fares

THE reason that street car transportation costs more and therefore demands a higher fare in Cincinnati than in Cleveland is shown in a well-presented analysis of the relative situations in the two cities, which was recently made for the Cincinnati City Council by W. C. Culkins, Director of Street Railroads for the city of Cincinnati. Cincinnati patrons pay a 7-cent fare, while their cousins in Cleveland can secure six rides for 25 cents. Evidently desirous of being sure of their grounds in case they should make any demand upon the local street railway system, the members of the Council requested the Director of Street Railroads to make an investigation into the reason for the difference. That which follows is largely a digest of the report which Mr. Culkins has made, with the significant figures contained in his report set up in a table to show the comparative statistics.

In both cities the companies are operating under service-at-cost franchises based upon the same fundamental principles, but the method of applying these principles differs materially. To secure a fair period of comparison, the first eleven months of 1919 were taken. Primarily it must be borne in mind that street car service is a commodity, and like sugar, coal and other articles its price in one city cannot be fairly compared with that in another without taking into consideration the quality and cost of production and all other conditions affecting it.

Considering first the characteristics of the two cities, Cleveland has wide streets, flat surface and a gridiron layout of its principal sections, while Cincinnati has narrow streets and a hilly country, with a limited number of highways from the business center to the residential districts. In brief, Cleveland is almost an ideal city for street railway operation, while Cincinnati presents problems not found anywhere else in the country. Cleveland is a compact city, and long open spaces traversed by street cars in which little or no population is found, so characteristic of Cincinnati, do not exist in Cleveland. As a result, more miles of track are required in Cincinnati. From figures for the period mentioned, Cincinnati has 55.80 per cent more miles of track for the same number of passengers than has Cleveland. Longer car trips are necessary and earnings per mile of track are less in Cincinnati.

EFFECT OF TRAFFIC DENSITY AND TRANSFERS

The natural rate of fare in any city is determined by the cost of furnishing the service per car-mile divided by the number of passengers per car-mile. For example, if the company carries eight passengers per car-mile at a cost of 40 cents, the fare should be 5 cents; if only five passengers per car-mile are carried, the fare should be 8 cents. Under the service-at-cost plan, an increase in the number of passengers or a reduction in the number of car-miles by operating fewer cars with the same number of passengers will reduce fares, and conversely. The car rider pays for what he gets in proportion to the number paying. The figures indicate a much higher traffic density in Cleveland and a consequent lower cost.

But there are other reasons for lower fare possibilities in Cleveland. For example, in Cleveland a charge of one cent for a transfer is made and a second one is not given except on cross-town lines. In all other cases a passenger must pay a second fare. In Cincinnati transfers are free; over 18 per cent of the transfers are double transfers, 5 per cent are triple transfers and sometimes four transfers are allowed. If the same transfer charges had been applied in Cincinnati, $528,789.98 would have been realized in the eleven-month period. Cleveland car routes call for more transfers, as is evidenced by the fact that 37.49 per cent of the Cleveland riders took transfers and paid for them, while in Cincinnati, with free transfers, only 33.35 per cent took transfers.

Other important items are the fact that Cleveland has no half fare for children, whereas in Cincinnati the half rate amounts to $32,000 per annum; the Cleveland Railway Company pays no franchise tax, while in Cincinnati the company pays $350,000 per year; the skip-stop plan is in full operation in Cleveland, allowing higher schedule speeds, more trips per car and consequently fewer cars; in fact, Cleveland cars run 40 per cent faster than Cincinnati cars. Traffic regulations also affect cost of operation, and in Cleveland the superior rights of the street car rider are recognized because of his greater preponderance, the street car is given right of way and other regulations assist street car traffic. Cleveland operates on what is known as the "split run" method, splitting the platform man's hours into morning, afternoon and evening hours. This eliminates much overtime and permits a much lower proportion of regular to extra cars. This is impracticable in Cincinnati.

ANALYSIS OF COMPARATIVE STATISTICS INDICATING REASONS FOR FARE DIFFERENCES IN CINCINNATI AND CLEVELAND

	Cleveland	Cincinnati
Population	905,000	401,000
Area square miles	58.7	72
Density (population per square mile)	15,000	5,570
Revenue passengers per mile of track (eleven months)	894,900	405,900
Total passengers per mile of track (eleven months)	1,235,000	545,900
Average trip (car-miles, eleven months)	5.18	11.02
Passenger earnings per mile (eleven months)	$46,700	$24,100
Total revenue passengers (eleven months)	264,589,945	107,160,088
Total car-miles operated (eleven months)	32,736,697	19,342,223
Density of traffic, passengers per car-mile (eleven months)	8.08	5.54
Density of traffic, car-miles per 100 passengers (eleven months)	12.38	18.05
Total cost of service (November, 1919)	$1,339,099.10	$682,549.97
Total cost of service per car-mile (November, 1919)	45.33	39.26
Density of traffic, passengers per car-mile (November, 1919)	8.73	5.59
Cost per car-mile per revenue passenger (November, 1919), cents	5.22	7.02
Operating cost per car-mile (eleven months), cents	30.05	24.54
Sinking fund requirement (annual)	0 0	$82,445
City tax (annual)	0.0	$350,000
Base fare, cents	4.167	7 0
First transfer charge, cents	1 0	0 0
Second transfer charge, cents	4.167	0 0
Third transfer charge, cents	1 0	0 0

Operating Costs, Valuation and Rate of Return

That higher fares are not the result of high operating costs is shown by the fact that the cost per car-mile is higher in Cleveland than in Cincinnati. In fact, in every detail item except power cost the cost per car-mile was higher in Cleveland during the eleven-month period.

Overcapitalization of the Cincinnati system has been blamed for high fares, but Cleveland, even by scaling down to the lowest valuation per mile of track of any city in the country, realized little benefit. To quote Peter Witt, formerly Street Railroad Commissioner of Cleveland: "Yes, the 'water' was squeezed out, but the statement that its squeezing out has had a material effect on the rates of fare charged is far from the truth. . . . The outstanding stock and bond obligation . . . was reduced from $34,000,000 to $24,000,000. . . . Assume that . . . the $10,000,000 had not been squeezed out. . . . They (the car riders) would have been called upon to pay . . . $600,000 more than they did pay. . . . But with three hundred million riders the increase in the rate of fare, had the 'water' remained, would have been one-fifth of a cent." Similarly in Cincinnati, even taking the Cleveland valuation per mile of track, and eliminating the sinking fund payment, the reduction in fare would amount to only one-fifth of a cent in fare.

Another point is that in Cleveland it has been agreed, after arbitration, to allow 7 per cent on the Cleveland stock, while, under the Cincinnati ordinance, only 5.619 per cent is allowed and the return can be increased only as a reward for reducing fares.

If Cleveland conditions were established in Cincinnati—reduce cars until the density is eight passengers per car mile, eliminate taxes and sinking fund payment, introduce the skip-stop, add a similar transfer charge, eliminate half fares—the cost would be 4.99 cents per revenue passenger. But, in fairness, it should be said that it is not practicable to reduce service to eight passengers per car mile. However, elimination of city tax, introduction of the skip-stop, transfer charges, proper traffic regulation and similar moves would lower fares if Cincinnati wants it. There is no idea of criticising Cleveland service. The people there are satisfied with it.

But Cleveland cannot be regarded as typical of our American cities generally. This is shown by the fact that more than a hundred cities have higher fares than in Cincinnati and in fifty-nine of these the rate is 10 cents; 118 have a 7-cent fare and by reason of the zone system and charges of from 1 to 2 cents for transfers a ride costs more in a number of cities to a great number of the passengers.

In the few cities where the fares have been continued at the old rate there are conditions that must be considered. In New York the Public Utilities Commission has decided that the rate on the surface line should be 8 cents, but a political situation has held up the increase, 78 miles of track have been abandoned, and 700 miles of track are in the hands of the receivers. In Philadelphia, where much publicity has been given to the 5-cent fare, 70 per cent of the passengers must purchase a 3-cent exchange ticket and it is stated by public officials that the average fare is actually 7½ cents. Detroit has a density of traffic almost as great as Cleveland and hauls three times as many passengers as are hauled in Cincinnati on about the same number of miles of track.

These instances are given to further demonstrate the necessity of an inclusion of local and contractual conditions in any study of comparison of fares in different cities.

In the 6½ years since the National Safety Council was formed, with fourteen members, the number of industrial concerns and public utilities on the rolls had increased to 3,854 by March 1, 1920. The increase in 1919 was 253, and the annual rate in the first two months of 1920 was over 700.

Service at Cost in Memphis

Commission Recommends Plan with Several Novel Features — Accepted by City and Company — Fare Begins at 6 Cents

A DECISION which virtually established a service-at-cost plan for the Memphis Street Railway was rendered on March 15 by the Railroad Public Utilities Commission of the State of Tennessee.

The commission issued an order on June 12, 1919, authorizing the receivers of the company to establish a 6-cent emergency rate of fare, and further provided for an examination into the amounts invested in the property of the company upon which it or its receivers were entitled to a reasonable rate of return. This appraisal, as has been noted in these columns, was made jointly by Albert S. Richey of Worcester, Mass., representing the commission; J. H. Perkins of Birmingham, Ala., representing the receivers, and Ross W. Harris of Madison, Wis., representing the city of Memphis. Reports of the appraising engineers were filed with the commission on Dec. 13, 1919, and the commission held hearings on the rate case during January and February. The commission decided that the rate base should be $11,846,034, which was practically the amount found by Mr. Richey, the engineer for the commission. The commission further found that $7,600,000 represented the cost of the renewable property and that 3 per cent of that amount for the present should be set aside out of earnings for a renewal and replacement reserve.

As to the rate of return, the commission decided that it should be not less than 6½ per cent nor more than 7½ per cent on the rate base, as noted above. Taking into account estimates of operating expenses, as prepared by Mr. Harris, the city's engineer, and Mr. Tutwiler, one of the receivers and former president of the company, as well as renewal and replacement accrual and rate of return as stated, the commission determined that the proper present rate of fare should be 7 cents cash or 6½ cents by ticket, the latter to be sold in lots of ten for 65 cents.

The skip-stop plan of operation was retained, as it was shown that the cost of providing the same standard of service was reduced about $100,000 per annum thereby, but it was directed that the company should confer with the city as to modifications of it that might lessen the inconvenience without materially reducing economy.

Outline of Plan Is Published

During the progress of the hearings the service-at-cost plan was mentioned in the course of the testimony both of Mr. Richey and Mr. Harris, and this plan meeting with the approval of the city authorities, as well as of the receivers of the company, the commission's order provides for its adoption, in brief as follows:

The cost of service is first defined as including operating expenses, with such allowances for a renewal and replacement reserve as is later described, as well as taxes and a return on the investment.

It is provided that the accounts of the company shall be kept in accordance with the Interstate Commerce Commission's classification.

The standard of service which shall be provided by the company is, of course, subject at all times to the control of the commission. In this order the commission specifies that until such time as it may make further order the company shall provide not less than 0.155 nor more than 0.185 passenger car-miles for each revenue passenger carried. (NOTE.—This corresponds approximately to 6½ and 5½ revenue passengers per car-mile.)

The investment upon which a return is to be allowed as a part of the cost of service is as stated $11,846,034, as of July 1, 1919, plus or minus such amounts as have been or may be added or deducted since that date with the approval of the commission.

A renewal and replacement reserve is provided for, consisting of such amounts as have been or may be credited to such reserve after July 1, 1919, with future credits and charges as provided for in the current order. It is provided that the renewal and replacement reserve shall be credited monthly at the rate of 3 per cent of the investment in depreciable property until the balance in this reserve shall have reached the amount of $500,000; thereafter, whenever the balance in this reserve is more than $300,000 and less than $500,000, the monthly credit shall be at the rate of 3 per cent. Whenever the balance is more than $500,000 the monthly credit shall be at the rate of 2 per cent, and whenever the balance is less than $300,000 the monthly credit shall be at the rate of 4 per cent of the depreciable property. As stated above, the investment in depreciable property is taken as $7,600,000, as of July 1, 1919, plus or minus such amounts as have been or may be added or deducted after that date with the approval of the commission. The credits to this reserve, as above provided, are to be charged to operating expenses and considered as a part of service, and the amounts in this reserve are to be used for the sole purpose of providing renewals and replacements (other than ordinary maintenance) due to depreciation, obsolescence or abandonment, as may be approved by the commission from time to time.

The rate of return on investment is to be considered as a part of the cost of service and is to be allowed monthly at a rate per annum to be determined as follows: Whenever the "fare index fund" balance (surplus) is less than $60,000, the return is to be at the rate of 6½ per cent; whenever this balance is above $60,000, the return may be at any rate between 6½ and 7½ per cent which the company may be able to pay out of the current revenue after paying operating expenses, charges to reserves and tax accruals, but without decreasing the fare index fund balance below $60,000. It is further provided that if the earnings for any month, plus the balance then in the fare index fund, be insufficient to pay the minimum return, then such deficit in return payments are to be paid from the earnings of succeeding months, plus accrued interest at 6½ per cent per annum, before any amounts are added to the fare index fund.

The "fare index fund" is simply another name for "surplus" and is maintained by crediting to it monthly all revenues after the cost of service has been paid. It

is provided that the fare index fund shall be used to pay such deficits as may occur between revenues and the cost of service, and that it also shall serve to determine the rate of return on the investment, as above described, as well as the rate of fare as follows: Whenever on Jan. 1 or July 1 of any year the balance in the fare index fund shall be greater than $200,000 and shall have been increasing during the preceding two months the rate of fare shall be reduced to the next lower in the following list, but if on such dates the balance in this fund shall be less than $60,000 and shall have been decreasing during the preceding two months the rate of fare shall be increased to the next higher. It is further provided that in the event that the fare index fund continues to increase for the next two months after a decrease in fare or if it continues to decrease for two succeeding months after an increase in fare an emergency change in the rate of fare can be made to the next lower or higher, as the case may be, without waiting for the next succeeding Jan. 1 or July 1, but such emergency changes may be made only with the specific approval of the commission.

The rates of fare which automatically may be in effect in accordance with the operations of the fare index fund under this order are listed as follows:

1. 8 cents cash
2. 8 cents cash, with ten tickets for 75 cents
3. 7 cents cash
4. 7 cents cash, with ten tickets for 65 cents
5. 6 cents cash
6. 6 cents cash, with ten tickets for 55 cents
7. 5 cents cash

It is further provided that whenever fare No. 2 or fare No. 6, as listed above, shall go into effect the commission will extend this list either upward or downward, as may be necessary, and will make further additions from time to time, so that the list may always contain two rates of fare above and two below the rate of fare in effect at the time.

The order also provides that the company shall furnish detailed monthly statements of the results of its operation to the commission and provides for any special investigation which may be desired by the commission at any time. Specifically relative to the latter, the commission provides that inasmuch as the city of Memphis has expressed the desire to have a traffic survey made to determine whether or not as satisfactory service may be provided at less cost than at present the company is directed to co-operate with the city in making such a survey and one-half of the cost of it is to be paid by the company and charged to current operating expenses. The company is also directed to confer with the city authorities concerning possible modifications of the skip-stop plan which may be made without a material reduction in present economy of operation.

Company Will Start with 6-Cent Fare

After the order, as described above, had been determined upon by the commission and its principal features had been made known to the company and city officials the latter made strenuous objections to the initial rate of fare which was provided therein, viz., 7 cents cash, with ten tickets for 65 cents, and appealed to Judge McCall of the United States District Court, under whose direction the receivers are now operating the property. Judge McCall suggested to the receivers that they consent to an addendum to the proposed order of the commission to the effect that instead of beginning at the proposed initial fare the present fare of 6 cents be continued as a test fare for a period of three months from the date of putting the plan into operation. If at the end of three months the 6-cent fare shall not provide enough revenue to meet the cost of service, as described in the order of the commission, then the rate of fare automatically shall go to the initial rate provided for in the commission's order, and if at the end of the second three months this rate of fare shall not produce sufficient revenue, then the order as written by the commission shall go into full force and effect until changed by the commission or by a court or other tribunal having jurisdiction. It was suggested that the results at the end of both the first and second three months period be submitted to Judge McCall by sworn reports of the receivers at the end of such periods and that he should determine whether or not such results shall require a change in the rate of fare.

This suggestion was made by Judge McCall only on the understanding that the Mayor and Commissioners of the city of Memphis would co-operate with the receivers of the company in giving the new plan a fair trial. The Memphis City Commissioners accepted this suggestion of Judge McCall and the receivers also agreed to it, and these facts having been brought to the commission an addendum was added to the order of the commission providing for initial three months test periods with the initial rate of fare 6 cents.

The order of the commission was a majority one, one member (Commissioner Welch) dissenting as to the rate base (placing it at $10,236,646 instead of $11,846,034) and as to the initial rate of fare (placing it at 6 cents). All three members of the commission agreed as to the other features of the order, including the service-at-cost plan, requirements for renewals and replacement reserve, rate of return and fare scale.

Receivers Issue Statement

The receivers in a statement to the public, issued with the announcement of the commission, say:

As receivers of the Memphis Street Railway Company we have been and are officers of the court appointing us, and as such have impartially represented, as it has been our duty to do, the public, the creditors of the company and the owners of the property.

We have appeared before the state commission by order of the court, after the company had vainly appealed to the preceding city commission for relief, to insure proper service in Memphis and the restoration of solvency to the company, so that new capital may be available as extensions and additions to the property may become necessary.

We have contended for a fair valuation of the property, a fair rate of return, a necessary renewal and replacement reserve and a proper standard of service and revenue enough, but no more than enough, to insure service for the public and fair treatment of those who own the property. There is not a doubt in our minds about the absolute integrity of the members of the state commission who subscribed to its opinion, nor about their ability and their singleness of purpose and desire to reach just conclusions upon all issues.

As receivers we are quite willing to have the test of a 6-cent fare made as agreed upon. We hope it will prove unnecessary ever to make effective any higher fare and that even a lower fare may be eventually possible, but this will depend upon future volume of traffic and trend of operating expenses. It will of course be our purpose to do all possible to get the best results in service and net returns during the test period.

In conclusion we appeal to the city officials, the press and the public generally to remember that the street railway is a city essential, that those now in charge of it are entitled to co-operate in efforts to make it serve adequately those who must use it and that the investment in this property is legitimate and those interested financially are entitled to the fairest treatment.

Our action in agreeing to the further test of the 6-cent fare is not intended in any degree as an abandonment of the contentions made before the state commission nor as a criticism of its action, but is taken in pursuit of a desire to dispose of and settle a controversy which has been precipitated as to the sufficiency of a 6-cent fare in Memphis.

The date at which the ordinance was to go into effect was set as April 1, 1920.

Letter to the Editor

Concrete Stringer Track Good If Many Conditions Could Be Met

THE DENVER TRAMWAY COMPANY

DENVER, COL., March 27, 1920.

To the Editors:

We have taken a lively interest here in the tieless concrete track described in a recent issue of the JOURNAL. A number of years ago the Denver Tramway experimented with a concrete beam substructure designed to eliminate wood ties. This held up very well for a while, but later on it was necessary to remove it and go back to wood ties and ballast, the reason being that at the very outset it was difficult for the construction forces to obtain a uniform grade and alignment. The gradient particularly caused trouble. A rolling load, constantly encountering resistance due to the presence of foreign matter on the tracks, sets up a vibration in the foundation upon which it rolls. This in time disintegrates the foundation unless its mass is so great that the vibration is damped down to the point where it results only in abrasive stresses on the rail head. The construction used by us did not have sufficient depth of beam properly to withstand the vibration shock.

We are not in a position to criticise Mr. Taylor's concrete street railway track support as used in Anderson, but we have had some experience with concrete bents approximately 5 ft. high, spaced on 10 ft. centers and connected by a reinforced concrete beam approximately 18 in. thick, on which a standard 100-lb. T-section rail had been fastened by bolts through the beam. After a number of years the concrete surrounding the reinforcing rods became separated from the rods and fell off. In a concrete paving job done by this company a number of years ago chicken wire mesh was used for reinforceing the slab. We found in time that the pounding of horses' hoofs and the passage of heavy vehicles broke through the cement and exposed this wire mesh. In making joint repairs we found this mesh a nuisance.

This entire matter is just the old controversy of "rigid track structure" versus "resilient." There still is a great difference of opinion in regard to what is best and what will last the longest. We have some rigid track construction here that has stood up well. However, we have other rigid track structures, under heavy traffic, which have developed corrugation to a very marked degree. The following thoughts come to me regarding Mr. Taylor's structure:

Strains: I cannot see the need for wire mesh reinforcement through the slab. The strains are mostly compression, and there is very little tension.

Joints: I would gather that Mr. Taylor constructed his track with the idea that "the life of the joint is the life of the track." The use of a 42-in. channel under the joints seems heavy to us here.

Rigidity: The rigid construction necessitates the greatest care in having the track lines absolutely level and to a uniform gradient in order to prevent corrugation. The article did not state the method used to hold track to surface and line prior to and during the pouring of concrete.

Support: The placing of the 8-in. longitudinal bearing plates in the concrete form in such shape and in such manner as to insure the track being to gage, alignment and grade after the concrete has set must require a very careful and painstaking supervision, which, in the case of the labor we deal with, would be exceedingly difficult and expensive. I wonder if it would not be cheaper instead of using the 8-in. longitudinal plate and ⅝-in. hook bolts 14 in. long to substitute a light-weight continuous I-beam or T-section, which would afford a rigid bearing plate for the base of the rail. In the case of the concrete foundations experimented with by this company, the greatest difficulty resulted from the absence of a wearing plate next to the concrete.

Trench: I can see some saving in the amount of excavation necessary, or rather not necessary, with Mr. Taylor's structure as compared with ordinary track construction. However, if forms are used, then the fabricating and placing of these would, it seems to me, offset the amount saved in excavation.

Time Required: The statement in the article that concrete has been found to "wear better when it has been given plenty of time to harden" is very much to the point. In the case cited the concrete was allowed to cure for twenty-eight days. This length of time would be prohibitive on many of the larger systems, unless the construction program for a brand new piece of track permitted this much time to be taken. In this particular, the management of the street railway company is more often than not the victim of circumstances not of its initiation or control. The "city dads" and public opinion regulate the length of time that a street car company can keep a street to itself. It is my opinion, however, that the value of Mr. Taylor's structure would be greatly enhanced and its life prolonged by a long period of "cure" or "set."

General: With minor changes, Mr. Taylor's concrete track support should be approved by maintenance of way engineers generally. For permanence it should replace ballasted wood tie construction. With a heavy rail head and cars not of over-weight, his track should outlast that of any other type. Any company that can have all the time it needs to let the concrete cure should be able to construct according to the Taylor plan at less initial cost and with guarantee of greater permanence than by following any other plan, providing the expense incident to proper surfacing and alignment does not offset these advantages.

EDWARD A. WEST,
General Superintendent.

The Iowa Railway & Light Company, Cedar Rapids, Iowa, will adopt aluminum conductors for use on all transmission lines operating at 6,600 volts or more. The company already has 700 miles of aluminum conductors in use. The engineers have selected this construction believing that a stranded aluminum conductor with a steel core, if purchased to give equal conductivity with copper, will have greater strength and give lighter loading on the poles than copper wire.

Recent Happenings in Great Britain

The Need for Increased Fares Is the Principal Theme Underlying These Notes from Abroad

From Our Regular Correspondent

During February there was much lamentation among British electric traction undertakings over the present and prospective financial position, owing to the ever-growing cost of operation. This applied both as regards the tramways of the country and the London underground railways. As to the former, the gist of the matter was put in a memorandum by the Municipal Tramways Association, published on Feb. 21 as a preliminary to conferences of all British tramway authorities held in the end of the month to consider the present financial position.

Operating Expenses 20 Per Cent Higher

The statement says almost every tramway system is now being carried on at a loss. Yet the association is confronted with a further application for an increase of wages of 10s. per week, making the pay 44s. a week above pre-war rates. Either the fares must be substantially increased or tramways must depend on compulsory local rates. It is pointed out that more than 20 per cent of the municipally owned tramways in Great Britain are a charge on the local rates. The increase in the working costs has been 20 per cent higher than the increase of revenue. No proper provision can be made for renewals.

Preliminary to consideration by the joint industrial council for the tramway industry of renewed application by employees for increase of wages, the meetings above mentioned were held on Feb. 25 and 26 of the Municipal Tramways Association and of representatives of tramway companies respectively. The joint industrial council (which consists of representatives of employers and employed) met on Feb. 26. The application, which was presented to it by the National Transport Workers' Federation, was for an addition to wages such as would bring the total earnings up to 44s. per week per man above pre-war rates. At the close of the sitting it was announced that the employers' representatives had asked for an adjournment for a fortnight so that further facts might be elicited regarding the increases of wages in comparable industries and that statistics relating to the increase in the cost of living and the financial position of the tramway undertakings might be put in. A committee was appointed to make the necessary investigations and the council adjourned till March 11.

Underground Group Suffering

As to the financial condition of the underground railways group, including four railway companies and the London General Omnibus Company, it was voiced by Lord Ashfield when presiding at the annual meetings in February. He had a tale to tell of greatly increased gross revenue, but of correspondingly increased expenditure. Moreover, as some of the advances in wages or shortening of hours only came into force near the end of the year little of their effect is shown in the accounts for 1919. It is not possible here to go into details of the figures, but generally it may be said that by means of government subvention to the Metropolitan District Railway (which is the only one of the group under government control and guarantee) and with the aid and the operation of the common fund of five companies it was possible to pay dividends for the year at reduced, and for the most part at little more than nominal, rates. The omnibus company used to do best. It is now doing the worst. After providing for working expenses, fixed charges and reserve fund there was a debit balance of £424,000. The biggest credit balance was that of the District Railway, namely, £781,000, including the government subsidy of £566,000. Lord Ashfield stated at the meeting of the District company that on each passenger carried last year by the five undertakings there had been an actual loss of 0.07d. If regard had been given to the necessity of making adequate allowance for depreciation and a return to the shareholders of only 4 per cent had been assumed then the loss would have been 0.38d. per passenger.

Return of Less Than 3 Per Cent

In his address to the shareholders of the City & South London Railway Lord Ashfield focussed the whole position thus: The gross earnings of five companies for last year amounted to £10,240,469 and the expenses absorbed £9,744,082, which left a balance of only £496,387. This was the whole sum available for the payment of dividends on a capital totaling more than £20,000,000 and secured a return of less than 2½ per cent. Omitting the government subsidy and making an allowance for depreciation the companies were working at an actual loss. In view of these facts and of the fact that expenses are still going up the companies are promoting a bill in Parliament to enable them to charge higher fares and to abolish workmen's fares.

The opposition which the London County Council is offering to the bill of the underground railway companies is of a somewhat qualified kind. This was only to be expected, seeing that the County Council has already greatly increased the fares on its own tramways and is contemplating another increase. At a meeting of the Council on Feb. 10 it was resolved that the opposition should be directed so as to secure that only such fares were authorized and charged on the railways as were reasonably necessary. Another aspect came up in a report presented to the Council by the highways committee on Feb. 17. It said that one effect of the abolition of workmen's fares on the railways might be to throw an undue strain on the Council's tramways during the rush hours. The committee considered that whatever alterations in fares might be sanctioned the railway companies should be required to provide adequate accommodations for passengers during the heavy traffic hours. The committee also considered that any financial advantages granted to the railways should not be used to assist the allied omnibus companies in competing with the Council's tramways.

Drastic Action Necessary

A fresh move was made by the highways committee and the finance committee of the London County Council early in March when they issued reports recommending drastic action for dealing with the deficit on the working of the Council's tramways. The former committee proposed a further increase in ordinary fares based on 1.2 miles for a penny (1d. a mile is the statutory maximum), instead of 1.5 miles for a penny as at present and 1.8 miles for a penny prior to the last increase. The scheme provides for 2.4 miles for 2d., 3.6 miles for 3d., and for any longer distance there is a flat charge of 4d. The latter for long rides is the same as at present. Workmen's reduced return fares are to be abolished and their single fares are to be 1d., 2d. and 3d., according to distance. These changes are expected to reduce the estimated deficit for the year 1920-21 from £760,000 to £601,000. The next step suggested is to make application to the Ministry of Transport under the Statutory Undertakings (Temporary Increase of Charges) Act for sanction to increase the statutory maximum fare from 1d. a mile up to a limit of 50 per cent. The finance committee on its part proposes that provision for repayment of outstanding capital debt on the cumulative annuity system (3½ per cent table) should be made instead of on the instalment system as at present, and that for twelve years half the cost of renewals of track be charged to capital account, repayable within 12 years. This, with the aid of a heavy draft on the renewals fund, would meet the deficit for the current year.

Covered Buses to Be Tried

Considerable interest attaches to the fact that omnibuses with top-deck covers are about to be tried in Bradford and Liverpool. This is the first occasion on which the government has allowed the use of a roof to the upper deck of an omnibus. The Bradford vehicle is a trackless electric trolley car, while the Liverpool one is driven by petrol. The Liverpool vehicle is also fitted with a life-guard for the front wheels. No design of the sort has hitherto proved practicable for omnibuses. The Bradford bus seats fifty-one passengers and the Liverpool one fifty-five. They are thus more spacious than the usual London type.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Subway Meetings Begin

Campaign Opened to Secure $15,000,000 to Start Cleveland Underground Construction

The initial meeting in preparation for the campaign in favor of the issue of $15,000,000 of bonds for the construction of the proposed subway system in Cleveland, Ohio, was held in the office of Mayor Harry L. Davis on March 26. In addition to city officials, representatives of a number of civic and other organizations were present.

Cleveland Must Be Shown

While no direct opposition developed, questions that were asked indicated that the need of the subway must be shown if its backers are to secure the support of some of the larger organizations. Suggestions pointing to other means of relieving congestion on the streets were made by some of those present, and the advisability of eliminating automobile parking on the streets was discussed as one of the principal means to this end.

C. A. Dykstra, secretary of the Civic League, who represented a special committee of that organization, stated that until a report had been made to the organization and its attitude toward the matter determined it would be embarrassing to him and his colleagues to be placed upon a boosting committee. While it was the desire of the backers of the project to form such a committee at this meeting, it was finally decided to call another meeting for April 5, in order to give the representatives of all organizations an opportunity to make reports and receive instructions.

Mayor Harry L. Davis urged favorable action on the proposed bond issue at this time and argued that the city must have improved means of transportation as soon as possible if it is to escape many limitations in growth and retain its importance as an industrial point. He was supported by Fielder Sanders, Street Railway Commissioner, who is struggling with problems of carrying the people and preventing congestion.

Mr. Brinckerhoff Summarizes Matter

Henry M. Brinckerhoff, of Parsons, Klapp, Brinckerhoff & Douglas, who prepared the subway plans, spoke at length on the proposition and answered many questions. The chief points made by him are as follows:

Cities that have subways commenced to develop rapid transit systems when the population was around 1,000,000.

Cleveland has an advantage over other rapid transit cities in that the Tayler franchise plan enables it to have a unified transportation development. This probably will keep the per capita cost down to around $70, as compared with $100 or more in cities like New York, Brooklyn, Boston, Philadelphia and Chicago.

The function of a transportation system is to take people from where they live to where they work and back again. Cleveland's is largely a rush-hour problem. Cleveland has 48 per cent of walkers as compared with 28 per cent in Chicago and 24 per cent in Detroit. That is due largely to continuous employment in the same factory.

The Public Square has been made the transfer point in the system because nearly one-half of the traffic is involved in that central point. The future rapid transit trunk line, because of the trend of traffic, must go through the Public Square.

The first step in rapid transit should be the establishment of a central terminal point from which the city can develop its system as the trend of population and business determines.

Cleveland should not tie itself up by attempting construction of any considerable length of rapid transit tubes, by committing itself to a beforehand guess at which way the city will grow.

The present plans provide for through routes east, west and south and looping to prevent unprofitable car mileage.

The necessity of making provision now is indicated by an increase of 19 per cent in the number of car riders last winter, sufficient, if maintained, to double the traffic in about five years.

It will take three years to build the subways. Cleveland can save $25 to $30 per capita by building its subways as a start for rapid transit now.

A day or two later Mr. Brinckerhoff announced the cost of the different branches of the proposed subway, based upon the present cost of labor and price of materials. The portion between the Public Square and the new high-level bridge on Superior Avenue, N. W., including the two loops necessary at the square, will cost $4,400,000. To place Euclid Avenue cars in a subway between East Twenty-second Street and the Public Square and build loop No. 3, thus establishing through connection between the east and west sides, the estimated cost will be $5,500,000. The Ontario Street subway will cost $2,500,000 and the St. Clair Avenue portion $2,400,000.

Kansas Plan Regarded as Unworkable

Herbert C. Hoover is not provincial. Because he is not provincial he has come out openly against the new Kansas labor law. He decries the law and predicts that the difficulties in labor compulsion in Australia will be repeated here. Mr. Hoover looms large on the political horizon at this time. His opinions are of considerable import at any time, but extraordinary importance attaches to them just now. In an address before the Chamber of Commerce of Boston on March 24 he discussed the relationship of employer and employee as considered by the National Industrial Conference, of which he is a member, and the difference in viewpoint of the conference and the Kansas legislation for the judicial settlement of labor disputes.

Will Unify Voltages

Indiana Company Proposes to Make Important Line and Power Changes

It is proposed to eliminate the two voltages on the system of the Interstate Public Service Company, Indianapolis, Ind. This will greatly enhance the flexibility of operation of both freight and passenger service. The Interstate Public Service Company took over the Indianapolis & Louisville Traction Railway in June, 1918. This is a 1,200-volt line.

Through Operation Limited

As a result of this purchase, the Indianapolis & Louisville has been limited to those cars which are equipped for both 600-volt and 1,200-volt operation. This limiting feature is now to be removed by changing over the 1,200-volt section between Seymour and Sellersburg, Ohio, for 600-volt operation. Work is expected to be completed by June 1, 1920.

This section of the line was formerly equipped with one substation in which there were installed two pairs of 500-kw., 600-volt converters which operated in series to produce the 1,200-volt trolley current. This substation will be replaced with five new substations, of which one at Langsdon will be of the automatic type. The others will be manually operated, since they will be located at points where there is a station agent or other employee who can also be utilized as the substation operator.

New Rolling Stock Purchased

The company has purchased eight new 62-ft. all steel passenger cars on which delivery is expected early in June. These will be equipped with four 150-hp. motors each and will be used to haul from one to three trailers. During the summer months, heretofore, the company has been forced to operate the passenger trains in sections, sometimes as many as five sections being required to handle the traffic. With the new equipment it is planned to utilize trailers largely, rather than to operate the trains in sections.

The Interstate company is also planning to buy two combination dining and parlor cars like those furnished the Chicago, North Shore & Milwaukee Railroad by the Cincinnati Car Company. They will be used on the through limited trains between Indianapolis and Louisville which make the run in four hours.

The Interstate Public Service Company operates 62 miles of line. It is headed by Harry Reid of Indianapolis.

British Electrification Projects

Reports of Chairmen at Annual Meetings Show Plans for Increases in Electrical Working Provided Funds Can Be Obtained

At the recent annual meetings of British steam railway companies the chairmen of several of the companies made references to electrification schemes. An abstract of these is given below, along with explanatory notes.

LONDON & NORTH WESTERN RAILWAY.—Sir Gilbert Claughton said that the statement of capital expenditure required for the year 1920 included £150,000 for the widening of the line between Chalk Farm and Willesden for the electric service and it was in the interest of the railway that this work should be completed as early as possible for the increased traffic which the company might certainly expect in the future. Another large item was for new electric trains, without which the company could not establish its full service between London and Watford. In connection with the electrification of the company's London suburban lines, the government restriction during the war on the works necessary to complete the last section had been withdrawn. The works were now actively in progress. [Note.—The electrification of all London & North Western suburban lines was begun before the war and, the delay being removed, the work should soon be completed. The scheme embraces also the North London Railway, an allied line. The through connection between Watford, some 20 miles out, and Baker Street and Waterloo underground railway is working regularly.]

TREMENDOUS INCREASE IN TRAFFIC

LONDON & SOUTH WESTERN RAILWAY.—Brig.-Gen. H. W. Drummond said that in 1913 the number of local passengers carried on the company's suburban lines which had been electrified was 25,000,000. Last year the company carried over those sections just under 48,000,000, an increase of 70,000 per day as compared with 1915, in the end of which year the first section began working electrically. The original electrification scheme, submitted in 1913, had to be cut because of the war. In June last the directors ordered the conversion of additional coaches so as to permit of the operation of trains of eight cars instead of six, but the conversion has been delayed by the molders' strike. Regarding the company's Waterloo & City underground line, the board had decided to supersede the present electrical equipment, which was out of date, by modern equipment and to extend the length of the trains. The estimated cost of this, including the necessary coaches, was about £750,000, or three times what it would have cost at prewar prices. Nothwithstanding all this, the advantages were so pronounced the directors have ordered the work to proceed.

GREAT EASTERN RAILWAY.—Sir A. E. Fellowes (deputy chairman) said that with a view to meeting the increasing demands made on the railway, the board had instructed General Manager Sir Henry Thornton to prepare a scheme of electrification. In Sir Henry's opinion the suburban area served by the Great Eastern Railway lent itself readily to electrification. The investigation had not proceeded far enough to permit prediction as to the financial results. [Note.—The Great Eastern Railway has for years had the largest suburban passenger traffic of any of the main lines running out of London. This electrification is long overdue.]

HOPES TO PROCEED WITH WORK SOON

LONDON, BRIGHTON & SOUTH COAST RAILWAY.—The Earl of Bessborough said that at the rush hours the number of trains into the company's London termini, Victoria and London Bridge, was so large, and the railway between London and Croydon was so congested, that it was not possible in existing circumstances to squeeze in another train. The great hope was in electrification. The relief obtained by the quicker working of electric trains in and out of the termini and the advantages those services showed over steam services in stopping and starting were so considerable that if they could only carry out the program laid down before the war to extend the electrical services throughout the whole of the suburban area the road could unquestionably improve the traveling facilities very much. The attention the government was giving to the matter encouraged the directors to hope that at an early date the road might be authorized to proceed with the work. [Note.—The inner suburban lines of this company have been worked electrically for some years.]

LANCASHIRE & YORKSHIRE RAILWAY.—E. B. Fielden said that the directors were satisfied with the results of the electrification of the company's lines, both in the Liverpool district and between Manchester and Bury, and they recommended an extension between Manchester and Oldham and on to Shaw and Royton. This would require an increase in power facilities. The traffic on the electrified lines in the neighborhood of Liverpool continued to grow. Touching on the financial prospects, the chairman said that, unless the government was prepared to find the capital, the proposed improvements would have to remain in abeyance.

GREAT WESTERN RAILWAY.—Viscount Churchill said that one of the principal works which the company had in hand at present was the electrification of the Ealing & Shepherd's Bush Railway. The line was completed in 1917 for steam trains, but it had only recently been possible to obtain contracts for its equipment for electric traction. The directors were hopeful that this work would be carried through in the course of a few months. [Note.—The line referred to is a junction railway some 3 miles long connecting the main line of the Great Western at Ealing with the western terminus of the Central London Railway. The only other electric railway belonging to the Great Western is a spur line of about the same length in the west of London connecting with the Metropolitan Railway (Inner Circle).]

NORTH EASTERN RAILWAY.—Lord Knaresborough said that the directors had for some time had under consideration and had provisionally sanctioned a scheme for the electrification of the main line between York and Newcastle (a distance of 80 miles), the details of which had been worked out by Sir Vincent Raven, the chief mechanical engineer, in consultation with the traffic officers of the company, and Messrs. Merz & McLellan, consulting electrical engineers to the company. On this part of the railway is a very heavy and varied traffic. [Note: Hitherto the experience of the company with electric traction had been confined to a multiple-unit passenger service between Newcastle, North Shields, Tynemouth and Whitley Bay, and the hauling of coal trains by electric locomotives between Shildon and Newport, Middlesbrough.]

Economic Necessity Their Compelling Motive

The employees of the Interborough Rapid Transit Company, New York, N. Y., have resumed their agitation for an increase in pay. P. J. Connelly, vice-president of the Brotherhood of Interborough Employees, headed a delegation named by the organization to wait upon the city authorities and endeavor to enlist their sympathies. The delegation called at the City Hall recently and in the absence of Mayor Hylan talked with F. H. La Guardia, president of the Board of Aldermen and acting Mayor.

A few weeks ago a similar delegation conferred with Frank Hedley, the president of the Interborough company. They asked for an increase of 25 per cent in their wages, and contended that the increase was promised them when they relinquished their fight for an increase of 50 per cent last August and accepted half the amount demanded.

After the conference with Mr. La Guardia, Mr. Connelly said:

> The acting Mayor told my committee that the city's investigation of the company was practically finished. He gave us the impression that the figures relating to the financial situation of the Interborough, as developed by the investigation, would be ready in a week or so. This was one of the things we went to see him about. The Interborough has been telling us that to grant another wage increase would force it into bankruptcy. The men are indifferent whether they work for the present management of the Interborough or for a receiver. They insist that they are entitled to live decently, and they don't care where the money for more wages comes from.

In Its Concluding Phase

Detroit on Eve of Election in Which City Seeks $15,000,000 to Build Railway

The Detroit (Mich.) United Railway's own ordinance must be approved as to form by Corporation Counsel Wilcox, according to an order in a writ of mandamus signed by Circuit Judges Webster, Mandell and Dingeman. If this decision is sustained the railway may proceed to obtain signatures to the petition for the ordinance, and after the proper number of signatures are obtained the ordinance will be submitted to the City Clerk, who must forward the measure with the signatures to the City Council within ten days. If passed by the City Council the ordinance will then go to the people for ratification, but if the Council fails to pass it within thirty days the measure will go to the people for decision.

City Will Appeal Ruling

Three questions raised in the application for a mandamus by Frank W. Brooks were reviewed by the judges in the joint decision. It was held, first, that the fact that the ordinance was submitted to the Corporation Counsel by a corporation and not by a qualified voter did not impair its standing.

The second question, as to the necessity of submitting a formal initiatory petition together with the form of the ordinance, was decided negatively. The third point, or the question as to whether or not the proposed ordinance was in proper form, was dwelt upon most fully by the judges. It was held that of the thirty-nine reasons advanced by Corporation Counsel Wilcox for refusing to approve the ordinance as to form only two, namely, that the title of the ordinance was defective and that the ordinance in question was a contract or franchise, related to the form.

In answering the contention that the proposed ordinance in question is also a contract or franchise, it was pointed out that the railway rights in Detroit have usually, if not invariably, in the past fifty years been granted by ordinance.

The ruling of the three judges will not be accepted as final by the Corporation Counsel, but an appeal to the State Supreme Court will be made for a review of the case, since the Corporation Counsel holds that the question involved is too far reaching to be left without a final ruling.

Problems to Be Overcome

In answering questions raised by the citizens' committee regarding the Couzens plan, Mr. Wilcox stated that in drafting the municipal ownership ordinance a contract to purchase the 34.25 miles of Detroit United Railway "day-to-day agreement" lines was not included in order that the city might be free to order those tracks torn up and be replaced by city-built lines.

It was claimed that it was impossible to present an ordinance divided into sections in which the construction features were separated from the purchase phase of the plan, since some voters who favored the construction of lines by the city might object to a purchase plan, or those who approved a purchase plan might not wish to approve a construction plan. The Corporation Counsel holds that the city may find it cheaper and more expedient to order the company to remove its tracks from the streets now operated as day-to-day lines and build the tracks itself.

These statements were made by Mr. Wilcox in answer to questions asked by the citizens' committee on street railway service, an organization formed by Detroit business men and others for the purpose of studying the Couzens plan and the Detroit United Railway proposal by comparison and analysis and to aid the voters in solving the problem now before the city. The committee asserts that the railway question ought to be settled by cool heads and accurate analysis rather than in any spirit of partisanship and selfishness.

The Mayor and his supporters contend that under the Couzens plan the public will get twice the amount of service it now gets, for the municipal lines not only will supply service with 101 miles of new track and 550 additional cars—half what the Detroit United Railway has for the whole city—but it will force the Detroit United Railway to give the best service it is able.

George Engel, former City Controller and present Commissioner of Public Works, points out that Detroit is in a better position to finance the construction of a railway than is the Detroit United Railway. Detroit municipal bonds are sought by investors at 4½ per cent, Detroit having the lowest bonded indebtedness of any city in the country in proportion to its wealth, while the Detroit United Railway would probably have to pay 8 per cent for the money necessary for it to finance its own program, if the company were to compete for funds in the open market.

In a final plea to the voters to defeat the Couzens plan on April 5 the Detroit United Railway supporters claim that the Mayor's plan means:

Two railway systems and double and triple fares with no fixed rate of fare on the municipal line.

Duplication of plant and fewer cars per mile of track than are operated now.

Years of litigation as to the price to be paid for lines taken over by the city.

Delay in building extensions, as all bonds must be voted. The $15,000,000 is only the start of the expenditures, as the A and B lines or the first lines to be built cannot be equipped for less than $10,000,000 more than the bond issue. No allowance for the C lines and no organization to carry on the work.

Curtailing water and lighting extensions, as such come out of the same utility bonds as any city car system, and these bonds cannot exceed 2 per cent of the assessed valuation.

It is maintained that the Detroit United Railway service-at-cost plan means:

One system with one fare and free transfers, and the extension of one fare to all the city, including territory that may be added. Twenty million dollars in extensions and equipment will be extended now when needed.

Service controlled by the Common Council and operated by experienced railway men and engineers, with the city reserving the right to purchase or lease the property, all franchises, some perpetual, to be canceled. Company agrees to equip and operate subways and elevated when constructed. Separation of city from interurban accounts by forming of new company. Construction work to begin immediately with material the company now has on hand.

Wages Become a Problem in Toledo

City Faces Another Shutdown of Its Railway Unless Satisfactory Temporary Fare Is Installed

Seven-cent fares with 2-cent transfers or nine tickets for 60 cents appeared to be the latest development in the Toledo railway situation during the week ended April 3. The present fare is 6 cents with 2 cents for each transfer. City, company and labor union officials have been in conference for several days attempting to justify the increased fare with the wage demands of the men. Mayor Schreiber is contending for a scheme to lower fares to workingmen and transfer passengers, making the "straight" riders pay the increase.

The company officials, who proposed the 7 and 2 cent rate, say they will lose $90,000 annually and not be able to increase the wages over 54, 56 and 58 cents an hour. At present the men are getting 42, 44 and 46 cents an hour. They asked for 55, 57 and 60 cents an hour.

The Mayor has tried to get the company to agree to free transfers during rush hours on a 7 and 1 cent basis all day.

The wage agreements expired on April 1 and the men declare they will strike if their minimum is not granted. They have set the minimum at 10 cents lower than the original demand. Whatever agreement is reached in conferences will have to be submitted to the Council for ratification as an amendment to the ordinance repealing the famous "ouster" ordinance.

Company and union officials have agreed on all the working clauses and wage scales of the electrical workers. The men were granted an increase as a compromise. This increase was not enough to affect the operating costs of the railways to a very large extent.

If any scheme of tickets is decided upon the company has said that it will adopt the metal token plan in order to continue the use of the automatic fare register boxes it installed a few months ago. Toledo has not had car tickets for more than three years.

Henry L. Doherty has decided to tackle only one problem at a time in disposing of the wage question, the

demand of the Municipal Ownership Commission for a cash price for the Toledo railway property and in the submission of corrections and substitutions for the cost-of-service ordinance.

MANY CORRECTIONS TO BE SUBMITTED

Dewey C. Bailey, counsel for Mr. Doherty, has been working with the objections to the cost-of-service measure. As it was submitted to the company there were more than a hundred added features placed into the ordinance after Mr. Doherty's representatives left the sessions of the commission.

Mr. Doherty declared that the many corrections necessary would be made and submitted to the commission before the time limit of April 3 set by Federal Judge Killits.

Mr. Doherty has pointed out the impossibility of his acceptance of many of the propositions contained in the ordinance by reference to the clause governing the regulation of interurbans. He maintains that the interurbans are not made a party to the contract and do not have to abide by any agreements arrived at through arbitration. Whenever there is a disagreement between the operating company and the interurbans the ordinance provides that the city and interurbans shall have representatives on the board of arbitrators, but that the company shall not be represented. Whatever decision is reached cannot be enforced against the interurbans because they are not parties to the contract. Mr. Doherty declares there are many such provisions which make it impossible for him to operate under the cost-of-service plan as drafted by the commission.

The commission may change the measure drastically after Mr. Doherty's objections are received. However, Mr. Doherty has decided that he is about ready to bargain with the Municipal Ownership Commission. It has asked him for a "cash" price. But he is withholding this matter till the wage propositions and other matters are cleared away.

MR. DOHERTY ASKING $11,000,000

The price set upon the lines by Mr. Doherty is $11,000,000, of which 20 per cent will be cash and the remainder in lien bonds on the property. The valuation set upon the property by the city service director, David Goodwillie, and his assistants was $12,000,000 at present invoices, but $7,110,000 as a "fair" price. This latter valuation was the one taken by the cost-of-service commission in its franchise draft.

Mr. Doherty has said he will give the city a discount for the entire purchase if made in cash.

The decision of the Supreme Court which allows to the city the right to issue general credit bonds for the purchase of a transportation system has the limitation of the debt-contracting power held over against unlimited bonding.

County Auditor Gabe Cooper, who is also a member of the Municipal Ownership Commission, has given it out that the city's total limit of indebtedness would be approximately $20,000,000. The present indebtedness is $14,000,000 gross, but the net is about $9,000,000. This would allow the city to bond itself for approximately $11,000,000 for the purchase of the lines. The difference between the gross and net debt is accounted for by the self-sustaining waterworks and other properties and sinking fund accounts.

The general impression that the city could not raise more than $8,000,000 caused this inquiry into the debt-contracting limitations of the city.

Mr. Doherty expressed great surprise when he was told that the city would be able to issue bonds for the entire price which he had set.

The Municipal Ownership Commission conferred with Mayor James Couzens at Detroit last week in an effort to make a study of his methods of dealing with his street railway problem.

Chairman Henry W. Ashley of the commission will be sent to New York City to study transportation problems there. Mr. Ashley and Commissioner John B. Merrell are working with the law director of the city in drafting an ordinance providing for public ownership of the street railway.

Mr. Hanson Has Learned by Experience

Business leaders and workingmen of Toledo, Ohio, were addressed several times during the week ended March 13 by former Mayor Ole Hanson of Seattle, who told them the dangers that he had encountered in a municipally operated railway in his city. It was under Mr. Hanson that municipal ownership was brought about.

The Toledo men were advised to vote against any measure which would mortgage the property owned by taxpayers in order to buy the Toledo railway system. Mr. Hanson said:

> Don't let them tell you that everything is bad about municipal ownership or don't let the advocates of the proposition tell you that all you have to do is to buy the lines. It's a different story and a large part of it is in the management.

In a graphic story of his career as Mayor of Seattle he pointed out these weaknesses in the public ownership and management of the railway system there:

1. Low-priced managers put the business amounting to millions of dollars annually into the hands of wornout old employees or young apprentices in electric railway operation.
2. Laboring men consider the treasury of a street railway system a perpetual "Christmas tree."
3. The whole matter becomes a "political football" which is kicked about at every municipal election with higher wages as the goal.
4. Disloyalty is promoted by making workers, dissatisfied with any refusal of demands, enemies of the government.
5. By preventing improvements operation is made uneconomical. City Councils can very seldom see the effect of cost-cutting measures.

Mr. Hanson also declared that few cities realize the service of expert engineers with sufficient salary to keep a good man on the job any length of time.

Seattle Shake-Up Started

New Seattle Official Begins His Career With an Attack on the Municipal Railway

Since Mayor Hugh M. Caldwell of Seattle, Wash., took office, on March 15, fourteen positions in the Municipal Street Railway Department have been abolished and three heads of departments have resigned. Mayor Caldwell's initial movement, upon assuming his position as head of the city government, was to request City Comptroller Harry W. Carroll to furnish him with a statement showing complete financial operations of the railway department during 1919.

THREE PLACES ABOLISHED

The three resignations and the abolition of fourteen other positions means a reduction, it is claimed, of approximately $2,885 a month or $34,620 a year in salaries in the department.

The three resignations, which according to reports were desired by the Administration, were from Glenn Hoover, supervisor of publicity; H. M. Nuzum, service and equipment inspector, and George Walsh, real estate appraiser.

The positions abolished were general electric foreman, held by Glen Dunbar; assistant superintendent of equipment, occupied by A. B. Flannagan; junior accountant, head storekeeper, two instructors in power saving, one transportation inspector and six clerks and stenographers.

Mayor Caldwell is still undecided as to the appointment of a permanent head in the Public Utilities Department, saying the temporary appointments of E. D. O'Brien as acting superintendent of the Utilities Department and D. W. Henderson as superintendent of the Municipal Railway will continue in effect until he has decided definitely on what is to be done with the department.

Meanwhile Mayor Caldwell has instructed Corporation Counsel Walter F. Meier to prepare an ordinance creating the division of Municipal Street Railways. The members of the City Council have approved such an ordinance and it will be introduced at a special meeting of the Council to be held at an early date.

MAYOR DEMANDS THE FACTS

In his letter to Comptroller Carroll asking for a financial statement Mayor Caldwell said there are discrepancies in reports that have come to him regarding the finances of the Municipal Street Railway and he asks the official municipal bookkeeper to prepare a statement that will show actual conditions. The Mayor's communication follows in part:

> Some time last fall I read in the papers that the Municipal Street Railway had made a profit of more than $7,000, and only recently I read also in the daily papers a purported statement from the then superintendent of public utilities to the effect that the lines had lost about $18,000 during the same period. There is a discrepancy here of some $25,000.
>
> I should like to have a detailed statement so that I may know whether or not the Municipal Railway was operated at a profit or loss during the balance of 1919, after the lines were taken over by the city.

Ten-Cent Wage Advance

Denver Tramway Says City Must Now Provide Some Means by Which Company Can Meet Arbitration Finding

The arbitration proceedings in the wage controversy between the Denver (Col.) Tramway and Division 746 of the Amalgamated Association were brought to a close on March 18 with the handing down of an award by a majority of the board of arbitrators. One arbitrator filed a dissenting opinion.

Company Arbitrator Dissents

The trainmen were granted a flat increase of 10 cents an hour over the National War Labor Board scale previously effective. This makes the new wage schedule 53 cents for the first three months, 56 cents for the next nine months and 58 cents thereafter with time and one-half for overtime. The guarantee for extra trainmen was increased from $85 to $100 a month. Demands for an eight-hour day were denied.

The wages of male employees in the mechanical, track and bridge and building departments were increased by the same percentage that the maximum of the wage scale paid trainmen was increased. Employees in the carhouses were granted a wage scale of 52½ cents an hour for the first three months, 55½ cents for the next nine months, with 57½ cents an hour thereafter. A minimum wage of 52½ cents an hour was established for adult male employees.

The arbitrator for the company in the dissenting opinion which he filed stated that he did not concur in the award as it fixed a rate of pay higher than is required to provide a reasonable living wage and imposed such an excessive additional operating expense upon the railway that the company will be unable from its present revenues to render adequate public service, maintain its property and meet its obligations to investors. The dissenting opinion goes on to state that the maximum rate of pay for trainmen as fixed by the award is an increase of more than 20 per cent in the maximum award made by the National War Labor Board and an increase of more than 93 per cent in the maximum wage in effect when the world war began, and further that it is much higher than the average minimum wage paid trainmen in the employ of railways in cities having from 100,000 to 300,000 inhabitants.

Controversy Many Months Old

Attention is also drawn to the fact that in compliance with the provisions of the agreement under which the arbitration proceeded it was incumbent upon the Board of Arbitrators to give consideration not only to the question of reasonable compensation for the employees but to the maintenance of the public service and to the fair return which the owners of the property are entitled to upon the actual value of their property devoted to the public service.

The beginning of this controversy dates back to July of last year when the employees' union presented demands for an increase in the wage scale for trainmen to 60 cents the first three months, 65 cents the next nine months, with 70 cents thereafter; also for overtime pay and changes in working conditions. These demands were made following the action of the municipal authorities in reducing the rate of fare from 6 cents to 5 cents and the decision of the Colorado Supreme Court vesting in the municipal authorities jurisdiction over the rates of utilities operating in Denver and other home rule cities in Colorado. The reduction in the rate of fare necessitated a reduction in the wage scales which precipitated a four days' strike and brought about the higher wage demands. The strike was ended by the municipal authorities agreeing to restore the 6-cent fare and the employees agreeing to return to work on the National War Labor Board scale of wages with the understanding that their demands would be taken up and disposed of within a period of six months.

Arbitration Started Last November

Under the agreement of Sept. 4, 1919, between the company and the union the questions at issue were submitted on Nov. 19, 1919, to a board of arbitration consisting of William G. Evans, former president of the Denver Tramway, appointed by the company, and William C. Thornton, an insurance agent and a member of the Bookbinders' Union, appointed by the employees. Hamilton Armstrong, chief of police of Denver, was selected as the third arbitrator on Jan. 13, 1920.

The data filed by the company with the board of arbitrators brought out that on the basis of the October, 1919, earnings on the National War Labor Board scale the average annual compensation of its trainmen employees would be $1,578 for that year with an average of $1,836 for the 10 per cent of the men who earned the highest wages and $1,247 for the 10 per cent of the men who earned the lowest wages. Average annual earnings for shopmen were shown at $1,522 with a maximum of $1,992 and a minimum of $1,143, while the trackmen would average $1,325 with a maximum of $1,694 and a minimum of $1,134.

Comparisons made with other occupations in Denver showed that the annual average compensation of truck drivers is $1,125; retail grocery clerks, $1,026; express company employees, $1,170; mail carriers and clerks, $1,250; skilled mechanics, $1,500; carpenters, $1,100; bricklayers, $1,028. Sworn statements made by representatives of various labor unions before the Colorado Industrial Commission were submitted by the company in substantiation of its data.

Despite the authoritative and undisputed data filed by the company, one of the most important factors which influenced the decision of the two arbitrators who signed the award was undoubtedly the wage scales of 60 cents an hour and in excess thereof which had been agreed to in other cities.

The company has placed upon the municipal authorities the entire responsibility for solving the problem. In short, the company said:

> Thus the solution of the problem rests entirely with the city; either the 7-cent fare with the 58-cent scale of wages now made effective, or the 6-cent fare with the National War Labor Board scale of wages.
>
> The tramway is definitely out of politics and will make no campaign for or against either policy, but pledges its utmost efforts to give the best possible service permitted by the revenues, whatever may be the decision of the city. The problem presented is purely a question of business and sound economics. It is not a political question and should not be made a political issue.

Rochester Men Demand 100 Per Cent More

Wage increases of nearly 100 per cent, an eight-hour day and a six-day week are asked by the motormen, conductors and other employees of the New York State Railways. The demands, if accepted, will go into effect on May 1, when the present agreement with the union will expire. This scale also has been agreed upon by the union divisions in Syracuse and Utica.

In detail the compensation asked is 81, 83 and 85 cents an hour for motormen and conductors on city cars and 90 cents an hour for those on interurban lines. The scale now in effect fixes the men's compensation at 41, 43 and 45 cents an hour for city work and 47 cents an hour for interurban runs. The agreement which the Amalgamated has with the company virtually assures the settlement of differences between the company and the union by arbitration.

If the company were to meet the maximum demands of its employees on the Rochester lines it would mean an increase in the annual payroll of the New York State Railways of $2,120,000, according to James F. Hamilton, president of the company. Testimony which was presented at the recent hearings of the Public Service Commission indicated that the railway would need a 7-cent fare to operate its lines properly. If that is true, granting the maximum demands of the men would probably make a fare of 9 or 10 cents necessary. Each cent an hour the wages of the men are advanced will add $53,000 to the cost of operation of the Rochester lines, according to Mr. Hamilton. Mr. Hamilton said:

> It will be impossible for the company to meet the demands of its employees. A conference is to be called with the employees of the company within the next few weeks and I feel quite certain that when we sit around the table a fair and amicable adjustment will be made. I do not expect any trouble, for I am confident that the men will be fair and just and that the public of Rochester will not be inconvenienced.

M. O. Vote on April 6

Madison, Wis., Will Decide on That Day Whether It Will Take Over Local Railway

The electors of Madison, Wis., will vote on April 6 on the question of municipal ownership of the railway system. After a five-hour debate, the Common Council by a vote of ten to seven decided to submit to a referendum at the municipal election the question:

Shall the city of Madison acquire property actually used and useful for the convenience of the public of the Madison Railway Company?

This settled nearly a year of debate over municipal ownership in the Council and was the result of a majority and minority report of a special committee of the Common Council and citizens appointed to study the local situation. The railway contended it could not improve the service with its present 6-cent fare.

The majority report of the special committee recommended that the company be permitted to pay its indebtedness to the city of more than $36,000 for paving between its tracks in ten annual instalments; that the city assume the cost of such pavement in the future; that the use of one-man cars now permitted on one line be extended to other lines.

The minority report opposed all recommendations of the majority.

The fight for municipal ownership has been led by City Attorney William Ryan, who drafted the bill passed by the Legislature at the last session permitting the municipal ownership of railways upon referendum vote of the electors. The recent primary campaign for Mayor of Madison was waged on the referendum question. Blied and Kittleson, who favored the immediate referendum, defeated Mayor Sayles, who opposed the vote until the public had secured more information.

Not a Wheel Has Turned in Thirty Days at Dubuque

The trainmen of the Dubuque (Iowa) Electric Company went on strike on March 1 for a wage increase from 42 cents to 60 cents an hour. The company has not operated a car since that time. It offered the men a compromise wage of 50 cents an hour, with 5 cents extra for operating safety cars if these are later installed. The men rejected this.

There is no particular quarrel between the company and the men. The company continues to deal with the union and has told both the city authorities and the employees that it is willing to pay the men the wages they ask if any one can show them where the money is to come from. The net earnings for last year would be more than exceeded by the increase asked by the men.

The City Council passed an ordinance recently directing the company to begin operation of its cars within twenty-four hours, but the franchise which the company holds has a provision which protects it in case the cars are not operated because of a strike. The company officials have asked the union for suggestions as to what it thinks should be done. Meantime the company's attitude is that it is losing less money by permitting the cars to stand in the carhouse than by operating them at the increased wage.

Railways Escaped Serious Damage

Apparently the electric railways escaped the worst of the storm in the Central West. At least this was the trend of the information which the Chicago office of the ELECTRIC RAILWAY JOURNAL had been able to obtain up to March 31.

The Chicago Surface Lines lost forty poles on the Milwaukee Avenue line extension, so that about 4,000 ft. of trolley wire and feeder were dropped to the ground. The trolley wire and feeder were undamaged, however, and were put back in place on new poles. The cross-arms were destroyed for the most part.

The Aurora, Elgin & Chicago Railroad had some trouble in Elgin, where a few poles and some trolley lines were blown down. The building next door to the terminal station in Elgin was almost completely demolished and the débris blocked the entrance to the interurban station, but the station itself was not badly damaged.

The Chicago, North Shore & Milwaukee Railroad was tied up for about two and one-half hours through the blowing down of some trolley wire and some high tension line and poles. The center of this trouble was in Wilmette. The crossing gateman at Wilmette Avenue suffered a broken arm and other injuries when he was picked up with his shanty and stove and carried across the street.

The Chicago & West Towns Railway, Oak Park, had about 400 ft. of trolley wire blown down.

The tornado approached Toledo from the west, divided in the Maumee Valley and swept toward Lake Erie parallel to the river, avoiding Toledo by 15 miles on either side.

At Genoa part of the city was swept away and the Northwestern Ohio and the Lake Shore Electric suffered damage in poles blown over and service was interrupted for a period of nearly twelve hours.

On the west the Toledo & Western service was interrupted for three days when whole miles of trolley poles and high tension were swept away. The Toledo & Indiana suffered a similar loss and the town of Swanton, on its lines, was almost completely devastated. The Toledo, Bowling Green & Southern, the Toledo, Fostoria & Findlay and the Ohio Electric Railway were held up for several hours on Monday as a result of damage to lines.

In the city of Toledo telephone poles and electric lines were torn down along Summit Street.

News Notes

Property Damage Recovered in Strike Suit.—The International Railway, Buffalo, N. Y., will receive $3,317 from the county of Erie to cancel the judgment obtained as the result of the suit for damages resulting from the railway strike in 1913. The company has agreed to stop further litigation. The company sued for loss of revenue through alleged inadequate police protection. The verdict is only for actual property damage.

Toronto Will Extend Civic Line.—By a vote of fourteen to ten the City Council of Toronto, Ont., in committee, has decided in favor of the construction and equipment of the Mount Pleasant road civic car-line, at an estimated cost of $1,060,000, by using $117,060 remaining to the credit of By-law No. 7,629 and applying for a private bill to raise the balance of $943,000 by issuing debentures without the consent of the ratepayers.

Wheeling Men Prepare Wage Demands.—At a meeting of the executive board of the union of the electric railway workers of the Wheeling and Eastern Ohio districts, held during the week ended March 27, plans were completed to present the new wage scale to the railway officials of the Wheeling district. The old scale expires on April 30. A communication was read by Clyde E. Bartlebaugh, president of the union, stating that all the men of the Pittsburgh district had been granted a 10 per cent increase.

Buffalo Men Ask Increase.—Platform men and shopmen employed on the Buffalo, Niagara Falls and Lockport lines of the International Railway, Buffalo, N. Y., who are affiliated with the Buffalo local of the Amalgamated Association, have presented demands for a wage increase of approximately 60 per cent. The present agreement expires on May 1. The new scale of pay will be close to 90 cents an hour. An eight-hour day and a six-day week are also demanded by the men. The men are now receiving from 41 to 48 cents an hour.

Mr. Dempsey Being Tried Again.—The second trial of John J. Dempsey, former vice-president of the New York Consolidate Railroad (Brooklyn Rapid Transit System), charged with culpable negligence amounting to manslaughter in the second degree, began with the work of selecting a jury in the Supreme Court at Mineola on March 29. The charge grows out of the Malbone Street tunnel disaster in Brooklyn, which occurred in November, 1918, and in which ninety-two persons lost their lives and scores were injured. Mr. Dempsey was tried on similar charges last December, but the jury disagreed.

Financial and Corporate

Revenues Outstrip Expenses

Statistics for December Show Greater Comparative Increase in Revenues Than Operating Costs

A very favorable showing for December, 1919, is made by the electric railways reporting their monthly operating statistics to the information bureau of the American Electric Railway Association. In the first four of the eight accompanying tables a comparison of these returns is made with those of December, 1918, and the improvement made is brought out strikingly.

A Promising Showing Made

The feature of the tables is probably the relative increase per car-mile in the operating revenues and operating expenses. In all sections of the country the revenues are apparently increasing more rapidly than the expenses, a condition which has not existed since before the war, and which, if it really indicates the trend of permanent operating conditions, promises better times for the traction industry. However, too much importance should not be attached to the showing for one month; it is promising, but until the same trend can be established over a period of several months at least it is a promise which should be scrutinized warily. Meanwhile the details of the situation may be examined and studied.

Taking the country as a whole, the total railway operating revenues of the companies reporting increased from 40.14 cents to 47.00 cents per car-mile, or 17.09 per cent. The operating expenses increased from 34.51 cents to 35.60 cents per car-mile, an increase of only 3.16 per cent. This produced an increase in the net operating revenue of 102.48 per cent., the amount rising from 5.63 cents per car-mile in 1918 to 11.40 cents in 1919.

Large Increase in Net in West

Much of this large increase is due to conditions in the West, where the net operating revenue increased 343.49 per cent. In the East, where the bulk of the companies reporting operate, revenues increased 17.75 per cent while expenses were increasing 11.07 per cent per car-mile, producing an increase in the net operating revenue of 53.07 per cent per car-mile. In the South revenues increased 14.77 per cent per car-mile, expenses increased 6.38 per cent and net operating revenue 34.62 per cent.

The principal cause of this favorable showing is probably the large number of fare increases which has been in effect for a long time. These increases have now come to be accepted by the public as a matter of course. Whatever loss of riding occurred when the early increases went into effect has long since been made up and the normal increase in the number of passengers carried takes place from year to year under the new fares as it did under the old. Furthermore, the increases which have already been obtained have paved the way for additional increases, and now, when companies which have managed to struggle along on their original fares decide at last that they must go to a higher rate, the resentment against the advance is not as marked as that manifested toward the pioneer increases. In consequence there is not so great a falling off in the riding habit. In short, the fetich of the 5-cent fare is losing its potency.

Explanations Offered

The showing in the West is, of course, abnormal. It is probably due in part, at least, to the lingering effects of the influenza epidemic in 1918. It will be remembered that the epidemic occurred later in the West than in the other sections of the country and lingered there long after it had disappeared elsewhere.

Another cause of this showing in the West is that a number of the companies conducted extensive repairs and improvements in their roadbed and tracks in December, 1918, and as a consequence their expenses for way and structures were abnormally heavy and several times as great as in December, 1919, thus producing an effect of falling off in expenses for the latter month.

As in the past, the returns from both city and interurban companies have been classified according to the following geographic grouping: Eastern District—east of the Mississippi River and north of the Ohio River; Southern District—south of the Ohio River and east of the Mississippi River; Western District—west of the Mississippi River.

Ohio Road May Be Abandoned

That the Toledo & Western Railroad, which operates between Toledo and Pioneer, Ohio, with a branch to Adrian, Mich., may be abandoned because it does not pay was the information given to members of the Morenci, Mich., Chamber of Commerce recently by business men and railroad officials.

Frank Coates, president, and party had inspected the lines and were being entertained by Morenci business men. He told them that the motor truck and motor passenger business had cut into the revenue of the line enormously at a time when costs were advancing and fares remaining low.

Cars have been removed to cut down the cost of operation, but the road still shows a deficit. The roadbed and the equipment are in need of repair, but Mr. Coates said there was no money available to do the work.

Morenci would lose its largest industry and Pioneer would be without rail communication if the line is abandoned. The road is a Doherty property.

Puget Sound Company Changes Its Name

At a special meeting of the stockholders of the Puget Sound Traction, Light & Power Company, Seattle, Wash., on March 23 the stockholders voted to authorize the issue of $10,000,000 of 7 per cent cumulative prior preferred stock and to change the name of the company to Puget Sound Power & Light Company. The authorization of this issue of stock puts the company in a better position to finance its requirements, both as to the liquidation of its floating debt and as to financing expenditures required to take care of new business. The position of the present outstanding 6 per cent preferred stock is materially strengthened by this method of financing, which should advance the prospects of the resumption of the full dividend rate of 6 per cent.

A circular about the change issued in anticipation of the meeting explained matters as follows:

> Since the refunding of the short-term notes in June, 1918, it has been necessary to spend very considerable sums for construction purposes to keep pace with general development stimulated by the war and to bring into full use those portions of its plant, mainly water powers, which were not then fully loaded, not only to cover war necessities but also to improve the net earnings.
>
> The outlay has been amply justified by the improving net earnings, but it has made necessary borrowing from banks, the floating debt now amounting to $1,838,000. Additional funds will be needed from time to time to finance for like expenditures. Existing conditions require that bank borrowings should be kept at a minimum and also preclude the sale of more of the present 6 per cent preferred or common stock.
>
> Your directors believe that it would be highly undesirable if not impossible to finance all of the requirements by further increases in the funded debt, and they therefore recommend the issue of $10,000,000 of 7 per cent cumulative "prior preference stock," which it is their intention to dispose of from time to time as market conditions permit and requirements make desirable. The sale of stock not only will make it possible to maintain a more conservative balance between the debt and capital stock, but also will enable permanent borrowing on a more economical basis if it appears wise to resort to such borrowing.
>
> The company has sold to the city of Seattle its street railway system in that city for $15,000,000 of utility bonds which are held under the mortgages in substitution for the property sold. Our capital expenditures, therefore, will be largely devoted to the development of the electric light and power business, making advisable a change of name to Puget Sound Power & Light Company.

Much Financing Being Done

Corporate financing in March was on a large scale, the total issue of railroad, industrial and public utility bonds amounting to $251,336,000. Public utility financing accounted for $38,639,000.

TABLE I—INCOME STATEMENT OF THIRTY ELECTRIC RAILWAYS FOR DECEMBER, 1919, COMPARED WITH DECEMBER, 1918

	United States		East		South		West	
	1919	1918	1919	1918	1919	1918	1919	1918
Railway operating revenues	$3,841,224	$3,247,654	$2,504,587	$2,102,128	$147,673	$136,546	$1,188,964	$1,008,980
Railway operating expenses	2,908,943	2,792,050	1,987,168	1,767,600	96,252	95,982	825,523	928,468
Net operating revenue	932,281	455,604	517,419	334,528	51,423	40,564	363,441	80,512
Net revenue: Auxiliary operations	201,986	180,896	167,571	137,749	22,941	43,147	11,474	.....
Taxes	245,800	218,002	150,334	143,425	12,350	12,550	83,116	62,027
Operating income	888,467	418,498	534,656	328,852	62,014	71,161	291,797	18,485
Non-operating income	53,279	54,696	47,198	39,663	469	8,167	5,612	6,866
Gross income	941,746	473,194	581,854	368,515	62,483	79,328	297,409	25,351
Deductions from gross income	648,956	623,255	415,175	375,524	38,401	43,381	195,380	204,350
Net income	292,790	*150,061*	166,679	*7,009*	24,082	35,947	102,029	178,999
Operating ratio (per cent)	75 73	85 97	79 24	84 08	65 18	70 29	69 43	92 02
Car-miles operated	8,172,039	8,091,106	5,325,627	5,263,027	421,338	447,113	2,425,074	2,380,966

TABLE II—INCOME STATEMENT IN CENTS PER CAR-MILE OF THIRTY ELECTRIC RAILWAYS IN TABLE I, COMPARING DECEMBER, 1919, WITH DECEMBER, 1918

	United States			East			South			West		
	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase	1919	1918	Per Cent. Increase
Railway operating revenue	47.00	40 14	17.09	47 03	39.94	17.75	35.05	30.54	14 77	49.03	42.38	15 69
Railway operating expenses	35.60	34 51	3.16	37.31	33 59	11.07	22 84	21.47	6 38	34.04	39.00	*12 72*
Net operating revenue	11.40	5.63	102.48	9.72	6 35	53 07	12 21	9 07	34 62	14.99	3.38	343.49
Net revenue: Auxiliary operations	2.47	2.24	10.26	3 15	2 62	20 22	5 44	9 65	*43 63*	0 47	.....	.....
Taxes	3 01	2 69	11 80	2.82	2.72	3 67	2.93	2 81	4 27	3.43	2.61	31 42
Operating income	10 86	5.18	109.65	10 05	6.25	60 80	14 72	15.91	*7 48*	12.03	0.77	1,462 33
Non-operating income	0 65	0 68	*4 41*	0 89	0 75	18 66	0 11	1 83	*93 99*	0.23	0.29	*20 69*
Gross income	11.51	5 86	96.41	10 94	7 00	56 28	14 83	17 74	*16 40*	12 26	1 06	1,056.60
Deductions from gross income	7.94	7.70	3.12	7 80	7 13	9 40	9 11	9.70	*6 09*	8.06	8 58	*6 06*
Net income	3 57	*1 84*	.....	3 14	*0 13*	.....	5 72	8 04	*28 86*	4 20	7 52	.....
Operating ratio (per cent)	75 73	85 97	.....	79.24	84 08	.....	65 18	70 29	.....	69 43	92.02	.....
Car-miles operated	8,172,039	8,091,106	6.13	5,325,627	5,263,027	1 19	421,338	447,113	*5.76*	2,425,074	2,380,966	1.85

TABLE III—OPERATING EXPENSES OF *FORTY-TWO ELECTRIC RAILWAYS FOR DECEMBER, 1919, COMPARED WITH DECEMBER, 1918

	United States		East		South		West	
	1919	1918	1919	1918	1919	1918	1919	1918
Operating expenses	1$3,399,166	2$3,311,691	3$2,405,176	4$2,253,773	4$331,772	$275,966	$662,218	$781,952
Way and structures	412,300	552,448	322,393	321,436	26,119	25,490	63,788	205,522
Equipment	409,199	382,489	263,791	278,906	44,579	31,771	100,829	71,812
Power	594,599	597,289	499,092	462,759	16,713	16,328	78,794	118,202
Conducting transportation	1,469,387	1,276,160	959,733	832,556	192,512	155,760	317,142	287,844
Traffic	18,630	24,700	13,972	17,667	1,076	1,303	3,582	5,730
General and miscellaneous	468,752	454,706	319,896	316,550	50,773	45,314	98,083	92,842
Car-miles operated	10,859,756	10,619,575	6,677,745	6,561,715	1,459,358	1,367,617	2,722,653	2,690,243

* NOTE.—This table includes the expenses of the thirty companies shown in Tables I and II, and in addition twelve other companies, which are not included in Tables I and II, because of the fact that they do a power and light business and do not separate their railway taxes and fixed charges of their other business.

1Includes $25,299 express charges. 2Includes $23,839 express charges. 3Includes $26,299 express charges. 4Includes $23,899 express charges.

TABLE IV—OPERATING EXPENSES OF FORTY-TWO COMPANIES APPEARING IN TABLE III, SHOWING THE AMOUNTS IN CENTS PER CAR-MILE FOR DECEMBER, 1919, COMPARED WITH DECEMBER, 1918

	United States			East			South			West		
	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase	1919	1918	Per Cent Increase
Operating expenses	131.31	231.17	0 45	336 01	434.34	4.86	22.73	20.17	12 69	24.32	29 07	*16.34*
Way and structures	3 8	5 20	*26 93*	4 83	4 90	*1 43*	1 79	1.86	*3.76*	2 34	7.64	69 37
Equipment	3.77	3.60	4.72	3 95	4.25	*7 06*	3.05	2 33	30 90	3.71	2.67	38.90
Power	5 48	5 62	*2 49*	7 47	7 05	5 96	1.15	1.19	*3 37*	2.89	4 39	*34.17*
Conducting transportation	13.53	12 02	12 56	14 37	12.69	13.23	13.19	11.39	15 80	11.65	10 70	8 87
Traffic	0 17	0.23	*26 09*	0 21	0 27	*22.23*	0.07	0 09	*22 23*	0.13	0.22	*40 91*
General and miscellaneous	4 32	4 28	0 93	4.79	4 82	*0.62*	3.48	8 31	5.13	3.60	3 45	4.34
Car-miles operated	10,859,756	10,619,575	2.26	6,677,745	6,561,715	1.77	1,459,358	1,367,617	6.71	2,722,653	2,690,243	1 20

1Includes 0.24 cents per car-mile. 2Includes 0.22 cents per car-mile. 3Includes 0.39 cents per car-mile. 4Includes 0.35 cents per car-mile.

TABLE V—COMBINED INCOME STATEMENT OF *SEVENTY-THREE ELECTRIC RAILWAYS FOR DECEMBER, 1919

	United States	East	South	West
Railway operating revenue	$8,762,710	$5,583,231	$918,187	$2,261,292
Railway operating expenses	6,598,474	4,404,507	615,251	1,578,716
Net operating income	2,164,236	1,178,724	302,936	682,576
Net revenue: Auxiliary operations	541,330	445,982	22,941	72,407
Taxes	541,273	303,447	96,487	141,339
Operating income	2,164,293	1,321,259	229,390	613,644
Non-operating income	514,208	133,492	239,019	141,697
Gross income	2,678,501	1,454,751	468,409	755,341
Deductions from gross income	1,835,134	1,075,345	231,121	528,668
Net income	843,367	379,406	237,288	226,673
Operating ratio (per cent)	75 29	78 91	67 02	69 81
Car-miles operated	20,039,523	12,014,931	2,599,138	5,425,454

* Includes the companies shown in Tables I to IV and others for which the 1918 figures are not available

TABLE VI—COMBINED INCOME STATMENT OF TABLE V, SHOWING THE AMOUNTS IN CENTS PER CAR-MILE

	United States	East	South	West
Railway operating revenue	43.72	46.46	35.32	41.68
Railway operating expenses	32.92	36.66	23.67	29.10
Net operating income	10 80	9 80	11 65	12 58
Net revenue: Auxiliary operations	2 70	3 72	0 88	1 33
Taxes	2·70	2 53	3 71	2 61
Operating income	10 80	10.99	8.82	11.30
Non-operating income	2 57	1 11	9 20	2 61
Gross income	13 37	12 10	18 02	13 91
Deductions from gross income	9 16	8 95	8 89	9 74
Net income	4 21	3 15	9 13	4 17
Operating ratio (per cent)	75.29	78.91	67.02	69 81
Car-miles operated	20,039,523	12,014,931	2,599,138	5,425,454

TABLE VII—DETAILED STATEMENT OF THE OPERATING EXPENSES OF *NINETY-THREE ELECTRIC RAILWAYS FOR DECEMBER, 1919

	United States	East	South	West
Operating expenses	1$8,415,990	2$5,926,190	$890,790	$1,599,010
Way and structures	1,000,185	731,801	87,339	181,045
Equipment	1,063,046	743,990	109,387	209,669
Power	1,270,432	974,904	57,918	237,610
Conducting transportation	3,701,608	2,494,681	496,113	710,814
Traffic	34,888	25,676	1,803	7,409
General and miscellaneous	1,313,787	923,094	138,230	252,463
Car-miles operated	26,625,524	17,040,687	3,818,699	5,766,138

* This table includes the expenses of the seventy-three companies shown in Tables V and VI, and in addition twenty other companies which are not included in Tables V and VI because of the fact that they do a power and light business and do not separate their railway taxes and fixed charges from the taxes and fixed charges of their other business.

1 Includes $32,044 express charges
2 Includes $32,044 express charges.

TABLE VIII—DETAILED STATEMENT OF THE OPERATING EXPENSES OF THE NINETY-THREE COMPANIES APPEARING IN TABLE VII, SHOWING THE AMOUNTS IN CENTS PER CAR-MILE

	United States	East	South	West
Operating expenses	1 31.60	2 34.76	23.32	27.73
Way and structures	3.76	4.29	2.29	3.14
Equipment	3.99	4 36	2.85	3 64
Power	4.77	5.72	1.52	4.12
Conducting transportation	13.90	14.63	12.99	12 32
Traffic	0.13	0.15	0 05	0 13
General and miscellaneous	4.93	5.42	3.61	4.38
Car-miles operated	26,625,524	17,040,687	3,818,699	5,766,138

1 Includes 0.12 cent per car-mile for express charges
2 Includes 0.19 cent per car-mile for express charges.

Seattle Municipal Railway Lost $517,173

Apparent Profit of Line There Turned Into Deficit When Proper Allowance Is Made for Depreciation

According to a statement prepared by City Comptroller Harry W. Carroll, Seattle's municipal railway during the year ended Dec. 31, 1919, operated at a net loss of $517,173. This statement takes into consideration the depreciation of the railway property since the city of Seattle purchased the lines last April. The depreciation figure is given as $499,173.

The total expense of operation of the railway, including the depreciation item, was shown to be $4,675,326; total operating revenue for the period was $4,158,153. Regarding the item of depreciation, which was estimated by A. F. Whalley, of the State Bureau of Inspection and Supervision of Public Offices, in conjunction with Comptroller Carroll, Mayor Hugh M. Caldwell issued the following explanatory statement:

The item of $499,173 depreciation of road and equipment is taken from the figures just completed by the State Bureau of Inspection and Supervision of Public Offices. Mr. Whalley of this department has been working on the accounts for the last two months.

The depreciation figure has been segregated by him on the various units of plant according to the classification of plant accounts by the Interstate Commerce Commission, ranging from one-half of 1 per cent on units such as grading and ballast, to 20 per cent on miscellaneous equipment (automobiles, etc.).

On the lines purchased from the Puget Sound Traction, Light & Power Company the ledger value of $15,000,000 was taken, from which was deducted lands and other undepreciable property aggregating $647,719. In other words, the depreciation has been figured on the valuation of the lines taken over from the Traction Company of $14,352,281, representing the full purchase price of depreciable assets; in other words, the $499,173 depreciation charged is approximately 4 per cent of the total depreciable assets.

The State of New York Public Service Commission, Second District, advises in its classification adopted Aug. 20, 1918, that its experience shows in the operation of electric railways the depreciation on way and structures should not be less than 2 per cent nor more than 5 per cent per annum; that the depreciation on equipment should not be less than 2 per cent nor more than 10 per cent per annum on the average total cost of such assets. Applying the average or mean of these rates to the assets of the street railways of the Seattle Municipal Railway a figure is arrived at approximating very closely the amount charged to depreciation in 1919.

The Puget Sound Traction, Light & Power Company figured its depreciation while operating the lines at 20 per cent of the passenger revenue less the amount expended for maintenance. This was a purely arbitrary method of figuring depreciation and varied with the revenues and maintenance each year.

If the city paid $5,000,000 more than the lines were worth, as many people believe to be the case, the depreciation, of course, is being figured upon an inflated valuation. As I understand it, an engineer was employed to spread the $15,000,000 over the assets which were being turned over to the city and to estimate the proportionate value of each class of property or equipment making up the total. At an actual value of $10,000,000, the depreciation would be approximately $200,000 less per year.

For comparative purposes we find that the municipal railway lines of San Francisco for the year ended June, 1919, charged to depreciation $334,867.21 on a total valuation of $6,499,480. The method used in San Francisco took 14 per cent of the passenger revenues without any deduction for maintenance. This would be slightly more than 5 per cent on the valuation of $4,168,000, whereas the percentage used on the Seattle lines was slightly over 4 per cent.

The city of Seattle in its light and power plant has been and is now charging depreciation each year. For the year 1919 the sum of $244,128 was charged to depreciation, which on a valuation of approximately $7,600,000 of assets actually in service, would make the rate of depreciation approximately the same as that used for the street railway by the State Board of Accountants.

From the examination I have been able to make, it seems to me that the city must take one of two courses—it must continue to proceed on the $15,000,000 valuation and figure actual depreciation on what is equivalent to watered stock, or else it must make a new valuation and charge off in a lump sum the excess price paid for the lines and thereafter figure the actual depreciation on the actual value of the lines.

EXPENSE	
Operating:	
Way and structures (maintenance of roadway, buildings and grounds)	$282,993
Equipment (maintenance of cars, shop equipment, automobiles, etc.)	528,507
Power (power produced and purchased)	558,529
Conducting transportation (trainmen, carhouse and car service expense)	1,950,459
Traffic (advertising park and resort attractions)	2,228
General and miscellaneous (general office expenses, industrial insurance, injuries and damages, stationery and printing, store expense, rent of track and facilities)	245,109
Auto buses (expense of auto buses connecting outlying territory with end of car line)	904
	$3,568,729
Depreciation of road and equipment	499,173
	$4,067,902
Deductions from gross income:	
Interest on general bonds	$23,282
Interest on revenue bonds	579,683
Amortization of discount on revenue bonds	2,314
Miscellaneous interest (interest on railway fund warrants)	2,145
	$607,424
Total	$4,675,328
REVENUE	
Operating revenue:	
Passenger car service	$4,030,602
Special passenger car revenue	471
Auto bus service	274
Express service (carrying newspapers)	3,948
Freight service	32,112
Mail service	6,213
Municipal employment passenger service (police and firemen)	38,000
Miscellaneous transportation service	3,265
	$4,114,885
Miscellaneous revenue:	
Station and car privileges (advertising privileges on stations and cars)	$12,947
Rent of track and facilities	20,938
Rent of cars	8,523
Rent of real estate	4,638
Electric current sold	579
Other miscellaneous revenue	643
	$43,268
Total	$4,158,153
Net loss for 1919	$517,173

In submitting his report to Mayor Caldwell, Mr. Carroll attached the following commentary:

The statement of income, profit and loss of the City Railway Department does not include certain expenses, properly chargeable to railway operation, borne by the general fund and charged by authority of the legislative body of the city to the expense of the respective departments rendering the services.

When the city acquired the traction properties of the Puget Sound Traction, Light & Power Company on April 1, 1919, it became necessary to increase the number of employees in several general fund departments. In the corporation counsel's office, two assistants to the corporation counsel, five claim agents, one law clerk and two stenographers were added to the force. Owing to the large grist of damage claims and increased litigation, expense for office supplies, stationery and printing, postage, etc., was materially increased.

The total cost of the city railway legal business borne by the general fund in 1919 was about $20,000; the purchasing department expenses were increased approximately $5,000; the expense of the comptroller's department for auditing claims, issuing warrants and keeping accounts of the railway department cost in round figures $6,000. In addition, there was an increase in the city treasurer's office expense of about $1,000 for handling city railway business in 1919. In the Public Utilities Department, all of the superintendent's salary of $4,500 and half of the auditor's salary of $3,250 have been charged to that department and paid from the general fund, notwithstanding more than two-thirds of their time has been devoted to railway operation.

Altogether some $35,000 of expense for the railway department was paid in 1919 out of the general fund. It is true that the general fund receives 2 per cent per annum on all railway fund money on deposit in city depositories, which would amount to perhaps $15,000 in 1919.

Similar expenses of light and water utilities, though relatively small, are likewise borne by the general fund and are consistently subject to the same criticism.

Loans and advances have been made to the railway fund, altogether amounting to $200,000, by other funds, principally by the general fund, without charge for interest. This practice is not new. It has been the custom of the legislative body to make loans to other utilities from various funds without providing for interest payment thereon, same being in my judgment a questionable policy.

In the budget for 1920 provision was made by the City Council for reimbursement to the light department depreciation reserve fund of an item of $25,000 previously loaned by that fund to the railway department. In accordance with this plan, the $25,000 was included in the general fund tax levy for 1920, and in February of this year was paid by the general fund, thus relieving the railway fund of this liability and reducing the total loans and advances from $200,000 to $175,000. In other words, the city made a levy of $25,000 for the benefit of the city railway.

Another matter that should now be presented for consideration is the provision for redemption of outstanding railway bonds. On Feb. 1, 1922, $833,000 of the $15,000,000 of bonds issued the traction company will be due and payable. Each succeeding year till 1929 a like amount will fall due. Thereafter, this amount will be increased by the addition of other serial bonds falling due, yet no sinking fund provision has been made by the city to take care of these redemptions.

The accompanying table shows the figures of earnings contained in Comptroller Carroll's report.

Changes in the personnel of the railway are referred to elsewhere in this issue.

Tax Assessments Protested

The Brooklyn (N. Y.) Rapid Transit Company has obtained from Justice Lazansky in the Supreme Court twelve writs of certiorari in connection with its appeal for the reduction of the 1920 special franchise taxes levied by the State Tax Commissioner. The writs are returnable in the Supreme Court at Albany on May 10, when the commission will be required to show by what process it arrived on the valuations it estimated and the railroad companies will be given an opportunity to show that the companies' properties were much overvalued. The reductions in valuations asked by the various companies total more than $25,000,000, with actual tax reductions of several million dollars.

Rhode Island Agreement

Quick Change in Attitude of Security Holders Indicates Likelihood of Success of Reorganization Plan

The stockholders and bondholders of the United Traction & Electric Company and the Rhode Island Suburban Railway, Providence, R. I., have agreed upon a plan of reorganization of the Rhode Island Company. In a final desperate attempt to reach common ground, the traction and the suburban bondholders at a meeting on March 31 accepted the ultimatum of the stockholders.

SPEEDY ACTION NECESSARY

Action was necessary on March 31, if at all, to save the entire system from disintegration. It was the last day for the introduction of legislation in the General Assembly under the rules, except by unanimous consent, and this was recognized as impossible.

Several acts proposing sweeping changes in the laws regulating the electric railway transportation and motor bus systems were presented in the lower branch of the Assembly. It is now up to the Legislature to make possible the transformation of the electric railway properties.

Governor Beeckman, contrary to custom, appeared before the House on March 31 and appealed to the members to give prompt and favorable consideration to the measures for the best interests of the whole State. He said that the reorganization of the railway was a subject of the most vital importance to the State, and that upon passage of the acts presented depended the future welfare of the traction system. He said:

> Under the plan accepted this morning, there will be a saving of $560,000 in annual fixed charges, and in return for this the company asks relief aggregating about $300,000 or $400,000.
>
> I believe that if we do not grant this relief we are going to cut off a great part of our electric railway system certainly, and possibly all of it. If we do not pass these acts in some form the railway will go under the hammer. It is absurd to say that the legislation proposed would harm the jitneys or buses in any way. It does not mean that the fares are to be raised. That would be manifestly ridiculous.

Based upon the plan drawn up by the protective committees of both sets of bondholders on March 11, the settlement provides for the merging of all properties now operated by the Rhode Island Company in the United Electric Railways to be capitalized at $22,600,000.

SLIGHT CHANGE IN PLAN

The only change made in this plan, as originally made public, is to eliminate the sinking fund which was to have been established to extinguish the prior lien bonds in twenty-five years and which would have required an estimated fixed charge of $54,680 a year.

Under the provisions of the plan, the securities of the United Electric Railways will consist of $3,000,000 prior lien bonds, $11,100,000 general mortgage bonds and $8,500,000 stock. The prior lien mortgage is to be an open mortgage to secure bonds to the amount of $5,000,000. Of these, $3,000,000 will be not-to-exceed 7 per cent bonds, of which $1,000,000 will be issued at once for new money for the corporation. The remaining $2,000,000 would be issued hereafter, at not to exceed 7 per cent, if new money is required.

The holders of the traction bonds and suburban bonds agree to forego the defaulted interest on their bonds to the amount of $1,200,000. In addition to this they cut their principal by $1,400,000 and receive $1,400,000 in stock.

The stockholders will receive, for their present $8,000,000 holdings, $6,600,000 in the stock of the new corporation. Without the obligation to raise any new money they are to be subjected to a scaling of less than 20 per cent. Arrangements have been made by which the United Electric Railways will be able to get the $1,000,000 new money as soon as needed.

The plan is made subject to the obtaining from the General Assembly of suitable legislation, including the placing of railways, jitneys and motor buses under the supervision of the Public Utilities Commission as common carriers.

For their $9,000,000 holdings the traction bondholders are to receive $8,100,000 in general mortgage bonds, the interest rate to continue at 5 per cent, and $900,000 in stock.

The suburban bondholders will get in exchange for their $5,000,000 of 4 per cent bonds $2,000,000 of 4 per cent bonds, based on the prior lien, $2,500,000 of 4 per cent general mortgage bonds and $500,000 stock.

For all its electric railway properties in Rhode Island, the New Haven Railroad will get $500,000 in 5 per cent general mortgage bonds and $500,000 in stock.

The general mortgage will be a junior mortgage to the prior lien mortgage and will have a life of thirty years.

The amount of fixed charges to be met by the United Electric Railways by this plan would be $680,000 a year.

Financial News Notes

Additional Director Elected.—Isaac E. Sawyer of the Mechanics' Savings Bank, Holyoke, Mass., has been elected an additional director of the Holyoke Street Railway.

Middlesex & Boston Reopens Lexington Line.—The Middlesex & Boston Electric Company has reopened its line between Waltham and Lexington after a shutdown of about two months.

Operating Managers for New York Interurban.—Day & Zimmerman, Philadelphia, Pa., are planning to take over the Western New York & Pennsylvania Traction Company, Olean, N. Y., as operating managers.

Berkshire Service Suspended.—Due to shortage of funds and lack of coal together with the blocking of tracks by the heavy snow fall in January, the Berkshire Street Railway Pittsfield, Mass., has suspended all service in the Pittsfield district.

Abandonment Authorized.—The Public Service Commission for the Second District has granted permission to the Chautauqua Traction Company, Jamestown, N. Y., to abandon its lines between Westfield and Barcelona for the reason the road never paid.

Hingham Co-Operates in Financing Cost of Operation.—The town of Hingham, Mass., decided at the town meeting held on March 22 to appropriate $5,000 for aid in financing the operation of the lines in the town controlled by the Eastern Massachusetts Street Railway.

Equipment Purchased by Deferred Payments.—The Board of Public Utility Commissioners of New Jersey has approved the agreement of the Salem & Pennsgrove Traction Company, Salem, N. J., with the J. G. Brill Company, Philadelphia, for the purchase of six safety cars. The purchase price was $30,561. Thirty-six notes maturing at monthly intervals are to be given in payment for the cars.

Wants Abandonment Approved.—The Toledo, Bowling Green & Southern Traction Company, Toledo, Ohio, has filed a petition with the State Public Utilities Commission asking for permission to abandon service over its branch between Trombley and Jerry City, Ohio. The portion of the road is only 2 miles long. It is said to have been operated at a loss for several months. A hearing by the commission was set for April 2.

Holding Company Not Liable.—The United States Circuit Court of Appeals has sustained the ruling of a lower court that the Philadelphia Company is not liable for bond interest on underlying bonds of the Pittsburgh Railways. Suit was brought by B. C. Allen to hold the Philadelphia Company liable for accrued and current interest on $10,000,000 of first mortgage bonds of United Traction Company, a subsidiary of the Pittsburgh Railways.

Grand Rapids Seeks Valuation Data.—Mayor Gallmeyer of Grand Rapids, Mich., has invited the members of the State Public Utilities Commission to a conference for the discussion of the local utility problems. Among these are agreements with the gas company and the Grand Rapids Railway. An interim contrast is desired with the former, pending some form of stable settlement. As for the railway, that matter has not yet taken definite shape except that the city desires information about valuation methods and procedure in anticipation of the expiration of the railway franchise on April 21, 1921. The city contemplates retaining E. E. Brownell as consulting engineer to represent it. The company has retained as its representative William J. Hagenah, Hagenah & Erickson, Chicago.

Traffic and Transportation

Suggestions Adopted

Kansas City Railways Points to Many Improvements in Service During Past Few Months

Co-operating with the municipal authorities and civic organizations, the Kansas City (Mo.) Railways has recently put in effect a number of regulations calculated to relieve traffic congestion and speed up car schedules. The changes were recommended in the report of the committee of one hundred business men appointed by the Kansas City Chamber of Commerce to investigate traffic conditions and to report on a remedy for the congestion, especially in the business district. The committee's report was summarized in the ELECTRIC RAILWAY JOURNAL for March 20, page 614.

COMPANY HAS DONE ITS PART

The company has issued a statement through its official publication, the *Railwayan*, in which it calls attention to the fact that many of the committee's recommendations have been carried out since the body began its work several months ago. The carrying out of other recommendations rests entirely with the city and the public.

In the latter class the company places the proposal that its franchise be amended to include a service-at-cost clause providing for a variable fare and a variable rate of return upon the capital invested. The company points out that under the Public Service Commission operation the service-at-cost plan is already practically in effect.

The committee urged that charges such as licenses and street paving and cleaning, snow-removal and lighting costs be no longer charged against the company, since these only tend to increase the fare and have no place in the operating costs of an electric railway. The company's statement declares that the question of remitting these charges must also be decided by the city.

FRANCHISE CONDITIONS FULFILLED

It is pointed out that the company has fulfilled franchise requirements providing for extensions to its lines. The report recommends the repeal of the section of the franchise requiring certain prescribed investments in extension each year, and that only such extensions be required as the Board of Control deems necessary and believes will be self-sustaining. Other franchise changes, including the working out of uniform franchises for the lines in Missouri and Kansas, rest with the municipalities involved.

Interest money to the amount of more than $1,000,000 is to be invested in the property during 1920. The company points to this fact in noting the recommendation that new capital, so far as possible, be in the form of stock investment instead of bonds. Attention is called to the fact that under existing conditions there is no market for stock.

With regard to the committee's request that the company provide means of receiving and acting promptly upon complaints, the company states that all complaints and suggestions meet with prompt attention. To meet the demand that service in the outlying districts be adjusted to the actual demand, it is pointed out that the company has for some time been turning back cars on several lines.

INCREASE IN CAR SPEED

Increase in speed of cars, urged by the committee, has already been obtained, largely through the recommendations made by John A. Beeler. The company further states that it has for many years urged upon its employees the necessity of courteous treatment of the public. The committee's suggestion that looping in the downtown district be discontinued has been carried out by the Board of Control, which has discontinued looping wherever possible.

A resolution has been adopted by the City Council creating a traffic committee consisting of three aldermen each, from the upper and lower house, to confer with Mr. Beeler on ordinances which will provide for the further rerouting of cars, regulation of stops and other traffic measures.

Co-operation in Financing

The Eastern Massachusetts Street Railway, Boston, Mass., has prepared a plan for co-operation in financing and operating the railway lines in the towns of Dedham, Westwood, Norwood and Walpole, which if accepted by the towns served by the company will result in the continuance of the lines in these communities.

The plan calls for the contribution of $20,000 to be raised by the towns, to which will be added $40,000 to provide $60,000 required to rehabilitate the lines. If the $20,000 is raised the company will guarantee service for a period of one year.

In addition to the request for reimbursement, the Eastern Massachusetts Street Railway suggests that a committee be appointed from each community to co-operate with the trustees of the railway in the supervision of operation and the handling of questions and problems pertaining to service in the district.

The recent decision to discontinue service on these lines after April 1 will become effective if the plan proposed does not meet with acceptance by the communities.

Fare Increase Denied

Oregon Commission Hopes to Secure Approval of Program That Will Forestall Increase

The Public Service Commission of Oregon, in a decision handed down at Salem on March 23, held in abeyance the application of the Portland Railway, Light & Power Company for increased fares with which to meet its steadily increasing costs of operation and recommended that the much discussed proposal for the city of Portland to take over the tracks of the company be referred to the voters of Portland at the special State election to be held on May 21. By taking over these tracks it is estimated that the valuation of the company's properties would be reduced about $5,000,000. Under the provisions of the order the latter recommendation applies only to the tracks in the streets and does not include the entire traction system.

Problems which in the opinion of the majority of the commission should be referred to the voters for decision at the special election recommended by that body are as follows:

> Elimination of financial burdens, including the maintenance on paving already laid and estimated at $47,000; bridge rentals, $65,000; franchise taxes, $15,500; car licenses, $7,500; free transportation to city employees, $22,000; maintenance, depreciation, taxes and interest on prospective paving (average six months), $13,000, or an aggregate of $170,000.

The majority decision was signed by Fred G. Buchtel, chairman of the commission, and Fred Williams, while a dissenting decision urging an increase was written by H. H. Corey.

The majority opinion points out that the commission is reluctant under present conditions and circumstances to attempt to remedy the situation merely by increasing fares. It says:

> We seriously doubt whether any fare would result in a complete and final solution of the difficulties of the railroad corporation at this time. From our investigation and analysis of the data presented it is not at all unreasonable to assume that the acquisition of the tracks by the city, together with elimination of bridge tolls and other relief, would not only place the Portland railway system at present and for the future upon a sound financial basis, but permit of a prompt reduction in the present rate of fare.

Mayor Baker asserted that this solution of the transportation problem, indicated by the action of the commission in declining, for the present, to grant an increase in fares, is an obviously disagreeable one, but the best that can be afforded under the circumstances. The Mayor believes that the suggestion of the commission that the city acquire the trackage is the best way out of the transportation tangle, while declaring that he is in no respect converted to municipal ownership and that even the partial partnership proposal should be accepted only as a last expedient. He said that the City Council will discuss at an early date the advisability of placing both proposals on the ballot

In commenting editorially on the decision the Portland *Oregonian* said:

> It is obvious that some drastic and not wholly desirable remedy must be adopted

in the carfare situation in the interests not only of the company but of the community itself. Purchase by the city of the rails is of that class. It cannot logically be offered as an economy in operation. It is proposed as a measure of relief for the company for which all the people shall pay in lieu of that other form of relief—an increase in fares—for which the car riders alone would pay. It is a plan that will appear to the apprehensive as a first step toward full municipal ownership and operation. It is difficult to understand how, even if the plan were not thus enlarged, it could escape some of the drawbacks of the latter policy.

More P. R. T. Improvements Planned

Philadelphia Transit Director Proposes Plan for Operation of Frankford Line—Company Wants Equipment Fund

Recommendations looking to the improvement of electric railway service in Philadelphia, Pa., were submitted to the City Council on March 30 by the Philadelphia Rapid Transit Company and by William S. Twining, director of city transit. Director Twining presented to the Council a report outlining a plan for the operation and equipment of the Frankford elevated line, now nearing completion. The company asked permission to establish a $6,000,000 equipment fund to meet the need for additional rolling stock.

Director Twining's program for the operation of the Frankford elevated calls for a 5-cent fare for a ride between any station on the present Market Street subway-elevated line to any station on the Frankford line, with free surface transfer privileges. Mr. Twining proposed two courses of action in the event that the company refuses to come to a satisfactory agreement. First, Mr. Twining suggested the city should petition the Public Service Commission for a peremptory order demanding the company equip and operate the new elevated, or, second, that the city should construct additional lines in the central business district to serve as a feeder for the Frankford elevated in its present headless and tailless condition.

Would Give Thirty-Year Lease

In case the company agrees to operate the new line, it will, under Mr. Twining's plan, receive a lease from July 1, 1920, to July 1, 1957. A provision is inserted for cancellation by the city upon reasonable notice and upon fair terms. Mr. Twining's plan calls for an annual rental payment to the city of 4 per cent of the city's initial investment in the line, this sum to be increased by the interest charges on additions made by the city during the life of the lease. The rental would be a direct obligation upon the company and not contingent upon any other payment. Sinking fund payments on city bonds would not be included in the rental requirements.

The company's proposal to establish a $6,000,000 equipment fund, which took the form of an ordinance, was accompanied by a letter from W. C. Dunbar, vice-president in charge of accounting. Mr. Dunbar explained that the certificates to be issued would bear interest at 6 per cent annually, maturing in equal semi-annual instalments during a period of not more than ten years, and they would be secured by a lien on 1,500 surface and ninety-seven elevated-subway cars.

This proposed equipment trust certificate issue is required to finance immediate necessities and supply increased car-carrying capacity, said Mr. Dunbar. The financing of new lines and extensions is planned to be accomplished by the formation of new companies issuing first mortgage bonds to cover the cost of construction to be guaranteed by the P. R. T., which company will also be the sole owner of such nominal issue of capital stock as may be required. Plans for the issuance and sale of these bonds will be presented from time to time for the Council's approval. Mr. Dunbar said in part:

> Pursuant to the specific provisions of the second section of the 1907 contract stipulating that upon the occasion arising for any additions or betterments to the lines, power or equipment of the Philadelphia Rapid Transit System, a communication shall be submitted by this company to City Council setting forth the necessity for such additions or betterments requiring additional capital and properly chargeable to capital account together with the estimated cost thereof and a plan of financing, we beg to advise:
>
> 1. That it is necessary each year to undertake substantial expenditures for the improvement and upbuilding of the physical plant to meet the increasing demands for transportation with new construction and equipment.
>
> 2. That in accordance with the uniform system of accounts for electric railways prescribed by the Interstate Commerce Commission and adopted by the Public Service Commission of Pennsylvania, expenditures are properly chargeable to capital account when incurred for new and additional property or when constituting a betterment as represented by the additional cost or value of track, power plant, car equipment or other facilities installed in the replacement of existing property.
>
> 3. That additional capital is required by the Philadelphia Rapid Transit Company in order to meet expenditures for additions and betterments to property actually incurred during the year 1919, and for additions and betterments necessary to be undertaken at this time.
>
> 4. That during the year 1919 the sum of $1,521,269.16 was expended for additions and betterments to track, power plant, car equipment and other property; that the sum of $1,000,000 was borrowed by the company on short term note in order to meet these expenditures; and that this obligation must be met by the issuance and sale of a marketable security.
>
> 5. That the sum of $2,400,000 is urgently required to meet the immediate necessities.

Trailer Cars an Issue

The question of trailer car operation is a live issue in Chicago at the present time. In an order issued last November by the Public Utilities Commission the Chicago Surface Lines was directed to add 200 cars to the service within five months. For financial reasons, due to the frequent changes in rates of fare, the companies have not been able to carry out this order.

At a hearing before the commission on March 24, Henry A. Blair, president, explained this situation and said the company has undertaken to construct an experimental trailer in its own shops and he thought this would be ready in sixty days. The plans and specifications will be submitted to the commission. Most of the routes operated by the Surface Lines do not have loops at both ends, but there are a number of lines where it is believed two-car trains can be operated to advantage, particularly on some routes entering the business district.

At the same session before the commission complaints were made through the Attorney General's office that many cars were being held in depots during rush hours. In nearly every case it was explained that this was due to defective equipment or shortage of crews.

Buffalo Fares Discussed

Council Members Inclined to Reject Proposal for a Charge for Transfers

Members of the City Council of Buffalo, N. Y., have signified their intention of rejecting the proposal of the International Railway that the city join with the company in an application to the Public Service Commission, Second District, for an order providing for a basic 5-cent fare with a charge of 3 cents for the first transfer and 1 cent for each additional transfer, in place of the 7-cent fare order of last November.

Herbert G. Tulley, now president of the railway, says that as soon as the Council formally rejects the proposal the company will give the city ten days' notice that it will put the 7-cent fare into effect. Thomas E. Mitten, a member of the bondholders' protective committee and a big factor in the operation of the International, has been opposed to a 7-cent fare. It was he who suggested the 3-cent transfer charge.

After a series of conferences with the municipal authorities, Mr. Mitten and Mr. Tulley agreed to reduce the charge for the second transfer from 3 cents to 1 cent. Mayor George S. Buck says he might consent to a transfer charge if a 2-cent charge is made for the first transfer and a 1-cent charge for the second transfer. This the company refuses to consider.

Three of the five members of the City Council have publicly announced they will not allow the company to charge a 7-cent fare despite the action of the Public Service Commission and will carry the appeal to the United States Supreme Court for a decision as to whether or not the Public Service Commission's 7-cent fare order is constitutional in view of the company's franchise fixing a 5-cent fare with free transfers.

In his report to the City Council after an investigation into the number of passengers who use transfers, Mr. Tulley said that only 40 per cent of the riders use transfers. He believed it would not be fair to charge a straight 7-cent fare when a 3-cent transfer charge would serve the same purpose and only affect part of the patrons.

City Protests 8-Cent Fare in St. Louis

The Public Service Commission of Missouri has granted an extension of time to the United Railways, St. Louis, under which it may collect an 8-cent fare from single passengers over its lines until April 15. The city is demanding a rate of 7 cents, with four tickets to be sold for a quarter. The city contends that the valuation of $60,000,000 claimed by the company for rate-making purposes is $10,000,000 too high. The order of the commission authorizing the 8-cent fare was effective until March 20. The company asked for an indefinite extension.

Major C. E. Smith, consulting engineer of the city, was one of the principal witnesses for the city. He said that it was his belief $2,000,000 a year could be saved by the company by installing one-man cars and operating them intelligently. There were several sharp tilts between Mr. Smith and Thomas E. Francis, attorney for the company. Mr. Smith submitted thirty-two exhibits covering the operations of railway systems in various cities. His conclusion was that the St. Louis railway is being poorly managed. Mr. Francis at one point said:

> Never having operated a street railway system yourself, you are merely giving horseback opinions as to how the St. Louis line should be operated, are you not?

Mr. Smith replied that was a horseback question. He then said:

> I do know that some 600 street railway lines are operating one-man cars, and that the St. Louis system is from five to ten years behind more progressive systems. I have made it my business to learn these facts.

Colonel Albert T. Perkins, manager of the company, said it was the intention of the company to ask the commission for authority to expend probably $2,000,000 for new cars and something like $1,500,000 for replacing old tracks, and these sums would more than consume the reserve and depreciation funds.

Four 10-Cent Zones Established

Four 10-cent zones on each side of the Connecticut River for the 13 miles of track on each side owned by the Hartford & Springfield Street Railway were authorized by Judge Lucien F. Burpee of the Superior Court of Hartford County on March 19, after Receiver Harrison B. Freeman had informed the court that the bondholders had refused to advance any more money to the road.

The new rates mean an advance in fare from 61 to 66 cents on each side of the river, between Hartford and Springfield, the Connecticut Company and the Springfield Street Railway operating part of the road on either side of Mr. Freeman's company and allowing the Hartford & Springfield company's cars to run over their lines. The connecting lines will not increase fares.

Only a week before the receiver had received authority from Judge Burpee to borrow $10,000 to keep the road running, the court telling Mr. Freeman to see if things could not be put on a paying basis, "if Providence would let him."

The railway's line on the west side runs from Windsor to the Massachusetts line and on the east side from East Windsor Hill to the State line. The increase in fares awaits formal action by the Public Utilities Commission, which assured Mr. Freeman before he asked the court for the increase that it saw no reason for refusing it.

The interest on the bonds of the company has been in default for about two and one-half years and the taxes due to the State of Connecticut have not been paid for three years. Mr. Freeman is not particularly optimistic about the way in which patrons of the road will take the new rate.

Transportation News Notes

Monongahela Fare Case Presented.—The rate case of the Monongahela Valley Traction Company, Fairmont, W. Va., which asks for increased fares on its lines in Parkersburg, was submitted to the Public Service Commission on March 27. The commission has taken the matter under advisement.

Ten Cents Asked in Walla Walla.—The Walla Walla Valley Railway, Walla Walla, Wash., has filed with the State Pubic Service Commission a rate schedule under which it proposes to charge 10-cent fares in Walla Walla beginning April 15. The present fare is 8 cents.

One-Man Cars for Boston.—Edward Dana, general manager of the Boston (Mass.) Elevated Railway, has applied to the State Department of Public Utilities for authority to operate one-man safety cars on the company's lines. The road has contracted for thirty such cars.

Savannah Hearings Ended. — The Georgia Railroad Commission has concluded hearings at Savannah on the petition of the Savannah Electric Company to increase its fare and its lighting and power rates. C. M. Candler, chairman of the commission, stated that a decision would be announced shortly.

Seven Cents in Sheridan.—The Sheridan (Wyo.) Railway began charging 7-cent fares on March 15. The increase was authorized by the State Board of Equalization & Public Service Commission. The commission's order provided for the sale of twenty tickets for $1.25, making the ticket rate 6¼ cents. The fare was formerly 5 cents.

Higher Fare in Morristown.—Seven-cent fares became effective on the lines of the Morris County Traction Company, Morristown, N. J., on April 1. The increase was made under authority of the State Board of Public Utility Commissioners. The rate was formerly 6 cents. The board refused to allow the company to raise the price of school tickets from 3 cents to 3½ cents.

Six Cents in Little Rock.—The City Council of Little Rock, Ark., on March 23 passed an ordinance under the terms of which the Little Rock Railway & Electric Company will be permitted to raise its fare from 5 cents to 6 cents. The company will be required to spend $100,000 on additional equipment for rush-hour service within the next four months.

Denies 8-Cent Fare.—The Missouri Public Service Commission has denied the application of the Kansas City Railways for permission to charge 8-cent fares on its lines in Independence. The present 5-cent fare within the city limits has been ordered continued. The commission has authorized an increase in the rate between Kansas City and Independence to 10 cents. The order went into effect on April 1.

Fares Up on French Lines.—French tramways and bus lines are raising their fares. The Paris "Metro," or subway, has been authorized by the municipal authorities to increase its rates from 5 cents to 10 cents, first class, and from 3 cents to 6 cents, second class. Fares on the Paris surface lines and bus routes have been advanced from 5 cents to 12 cents, first class, and from 3 cents to 10 cents, second class.

Fights Nashville Increase.—A resolution calling for a committee of three to recommend an expert appraiser to examine the books of the Nashville Railway & Light Company, Nashville, Tenn., was recently adopted by the Nashville City Commission. The resolution charged the State Railroad & Public Utilities Commission with "unjust discrimination" against the city in permitting the company to raise its fare to 7 cents.

Would Grant 6-Cent Fare.—The Public Service Commission of Washington has been petitioned by the Hoquiam Commercial Club, Merchants' and Traders' Bureau and the Rotary Club to grant the Gray's Harbor Railway & Light Company, Aberdeen, a 6-cent fare. The company has filed with the commission a 7-cent schedule to replace its present 5-cent fare. The City Council of Aberdeen has protested the 7-cent fare to the State commission.

Ask More for New York Lines.—Two electric railways operating in New York State have applied to the Public Service Commission for the Second District for permission to raise their fares. The Peekskill Lighting & Railroad Company asks authority to charge a 7-cent fare in Peekskill for a period of one year. The fare is now 6 cents. The Peekskill trustees have already approved the increase. A 10-cent fare is asked by the Putnam & Westchester Traction Company, operating between Peekskill and Oregon.

Bulletin for Charlotte Carmen.—As a part of its campaign for improved public relations, the Piedmont & Northern Railway, Charlotte, N. C., has begun the publication of a semi-monthly bulletin, the *P. & N. Special*, which is to be sent free to all employees and all shippers served by its lines. This publication is to be edited by John Paul Lucas, director of public relations for the Southern Public Utilities Company, who has assumed a similar position with the railway.

More Cars for Subway.—The Interborough Rapid Transit Company, New York, N. Y., on March 25 placed in operation new service schedules called for by the order of the Public Service Commission for the First District for increased service in both rush hours and non-rush hours. The principal increases made are in non-rush hours. Trains are to be operated on more frequent headway and with an increased number of cars. The service as called for provides nearly 25,000 more seats than were operated daily prior to March 25. Increases are made in the evening non-rush hours as well as in day-time non-rush hours, while there has also been a material increase made in the local service operated in the west side subway in evening rush hours.

Would Raise Commutation Rate.—The Union Traction Company of Indiana, Anderson, Ind., has filed a petition with the State Public Service Commission asking for an increase in its commutation rates on all of its lines. The company asks that the rate of 1½ cents a mile on commutation books be changed to a basis of forty rides for the price of twenty-five full one-way tickets at 2¾ cents a mile. This would mean a rate of 1.64 cents a mile. The company asks that a minimum charge of from $3 to $4 be fixed for any book of tickets and that it have authority to put the new rates in effect on ten days' notice. It points out that the commission has granted commutation rates similar to those which it asks to traction companies in adjacent territory.

Must Pass on Jacksonville Fares.—The Supreme Court of Florida on March 19 handed down an opinion affirming the authority of the State Railroad Commission to fix rates of fare, municipal franchise ordinances notwithstanding. Under the court's order the commission is called upon to pass upon the petition of E. J. Triay, receiver for the Jacksonville Traction Company, for a 7-cent fare on the company's lines. Following the refusal of the Jacksonville voters to grant the higher rate, the receiver applied to the commission, which refused to act in the case on the ground of lack of jurisdiction. Mr. Triay then secured from the Supreme Court an alternative writ of mandamus directing the commission to hear the application. The commissioners thereupon asked the court to quash the writ.

Interurban Road Retrenching.—Package freight and other freight service was discontinued on March 15 on the lines of the Maumee Valley Railways & Light Company, connecting Toledo, Maumee and Perrysburg. The abandonment of the service has been approved by the Public Utilities Commission after the company showed that it had operated at a loss for some time. Approval of the passenger fare increase recently submitted to the commission is still pending. Several suggestions for curtailing passenger service have been presented, but company officials declare they are not feasible. Recently the company asked bondholders to allow an extension of one year with a higher rate of interest and an option on another extra year extension on account of the financial situation of the company.

Fargo Lines in Need.—The Fargo & Moorhead Street Railway, a subsidiary of the Northern States Power Company, which operates in Fargo, N. D., and Moorhead, Minn., has appealed to the authorities of these cities for financial relief. The Fargo City Commission has indicated its willingness to meet with representatives of the Moorhead City Council to consider the company's request with a view to granting it an increase in fare. In asking for additional income for the lines, M. L. Hibbard, general manager of the company, stated that net operating revenue for 1919 amounted to $3,185 and that wage increases made in January of this year involved additional expenditures of $7,500 annually. He pointed out that this increase in operating expenses would wipe out the apparent profit of 1919 and would create a deficit of over $4,000 in 1920.

New Publications

Controllers for Electric Motors

By Henry D. James. 354 pages. Illustrated. D. Van Nostrand Company, New York City.

This work is based on a series of articles originally published in the *Electric Journal* during 1917 and 1918. It refers particularly to industrial controllers, but it includes a chapter on series parallel control and the electropneumatic contactor. The book gives much practical information on this vital subject.

Diary for 1920

Published by the Electric Railway & Tramway Journal, 16 Eldon Street, London, E. C.

Besides containing a space for each day with blotter between the leaves, this diary gives the text of the 1919 transport act, award of the Court of Arbitration for workers, list of British tramways, railways, and light railway companies and their officials, together with a list of colonial and foreign railways with officials having offices in London, etc.

Statistics in Business

By Horace Secrist, Professor of Economics and Statistics, Northwestern University. 137 pages. Illustrated. McGraw-Hill Book Company, Inc., New York City.

In compact and readable form Dr. Secrist has given a lot of information regarding the collection, assimilation and presentation of data. In view of the increasing tendency to put facts into graphical form, such books as these should prove helpful and stimulating. In this book the author has something to say also regarding summarizing the facts, the deduction of averages, etc., a very important topic in electric railway analysis.

Design and Construction of Heat Engines

By W. E. Ninde, associate professor of mechanical engineering, Syracuse University. 704 pages. Illustrated. McGraw-Hill Book Company, Inc., New York, N. Y.

Professor Ninde states in his preface that the object of this book is to supply in one volume the material most essential to the well-equipped, independent designer of heat engines, and to give this material in the form most convenient for use in classroom and practical work by separate treatment of the different phases of the subject. He has based the book upon his notes covering twenty years of practice in this field and in the light of a teaching experience of ten years. The text is divided into sections on the heat engine, thermodynamics, friction and lubrication, power and thrust, mechanics and machine design. While the scope is very broad, the book seems to be well balanced and should be valuable not only as text in the classroom but as reference material for power-plant operating engineers.

Selling Your Services

By George Conover Pearson. Jordan-Goodwin Corporation, New York, N. Y. 237 pages, 5 in. x 7½ in. Price $2.

The book is filled with practical examples of advertisements, circular letters, application letters, follow-up letters, and telegrams, most of which have been actually used in obtaining better opportunities for technical men, salesmen, sales managers, foremen, accountants, advertising managers, clerks, stenographers, editors, etc. It is presented in very readable form and is completely indexed. "Selling Your Services" is not an instruction course. It tells the man seeking to sell his services how to take whatever knowledge and training he has now and find the best market, the market where his ability will be of the most value and therefore will give him the largest returns. Knowing that the same fundamental laws that are effective in selling any product apply equally well to selling a man's services, Mr. Pearson has given in simple, practical, usable form plans that any man can follow to conduct a resultful campaign to sell his own services. For the man who has no job, the man who has not the kind of job he desires, and the man who feels he has reached his limit in his present job, "Selling Your Services" should be of real benefit.

Personal Mention

New International President

Mr. Tulley Elected Head at Buffalo —Many Other Changes in Officers and Directors

Herbert G. Tulley of Philadelphia, vice-president of the Philadelphia (Pa.) Rapid Transit Company and acting president of the International Railway, Buffalo, N. Y., since the resignation of Edward G. Connette, has been elected president of the International. C. A. Weber, secretary to Thomas E. Mitten of the Philadelphia Rapid Transit Company, has been elected secretary of the International Railway, to succeed N. N. Ollie, who has been made assistant secretary. Willis C. Dunbar has been elected comptroller and E. J. Dickson has been re-elected vice-president.

These members of the board of directors have retired: S. R. Bertron, Rodman E. Griscom, Edward G. Connette, George Bullock, Francis T. Homer, Marshal J. Dodge, H. G. Pritchard, Henry W. Killeen, of counsel; John L. Clawson and Robert W. Pomeroy.

The new directors elected include Dr. Henry C. Buswell, Walter P. Cooke, chairman of the board of the Marine Trust Company, Buffalo; E. J. Dickson, vice-president; Willis C. Dunbar, Coleman J. Joyce, R. Walter Leigh, New York; Thomas E. Mitten, Philadelphia; Nelson Robinson, Carlton H. Smith, Herbert G. Tulley, president, and Carl A. Weber. Mr. Joyce is counsel for the Mitten interests.

The directors who hold over include John W. Barr, Jr., Louisville; Charles R. Huntley, president of the Buffalo General Electric Company; Thomas Penney, general counsel; Harry T. Ramsdell, Harry Yates and Henry C. Zeller.

The election of the new board means the elimination of the Bertron-Griscom interests of New York and the entrance of Mr. Mitten and Mr. Robinson and their associates into the active management of the Buffalo lines. A number of the new directors are Buffalo financiers. President Tulley has decided to make his home in Buffalo.

Mr. Tulley was born in England in 1872. He received his early training in the British Army, from which he was honorably discharged after several years' service in India. Coming to the United States, he entered the employ of the Chicago City Railway, where he met Thomas E. Mitten. When the Stotesbury-Mitten management took hold of the Philadelphia traction situation in 1911, Mr. Tulley was made assistant to the president of the Philadelphia Rapid Transit Company. In December, 1918, he was advanced to vice-president of the company. When Mr. Mitten took over the direction of the International Railway, following Mr. Connette's resignation, Mr. Tulley was made acting president of that road. A portrait and biography of Mr. Tulley were published in the ELECTRIC RAILWAY JOURNAL for Dec. 21, 1918.

J. V. Sullivan, Executive

From Figuring About Facts, Chicago Statistician Turns to Face Facts With Figures

J. V. Sullivan, statistician of the Chicago (Ill.) Surface Lines, has received from Henry A. Blair the signal promotion to the position of assistant to the president. In his new capacity Mr. Sullivan will be entrusted with duties of a highly responsible nature.



J. V. SULLIVAN

For the immediate future his time will be largely occupied in working with John A. Beeler, consulting engineer, who is making an extended study of the traffic conditions, equipment and organization of the Surface Lines. Thereafter, he will presumably work closely with Williston Fish, general manager, in carrying out Mr. Beeler's recommendations and in bringing about operating economies and general improvements in the service.

Mr. Sullivan takes up his new duties with a well-rounded knowledge of transportation matters gained through sixteen years of service with the electric railways of Chicago, during which he has had many opportunities for study of the systems in other cities as well. His experience in the broad aspects of these matters has also been enhanced through service during the past several years as a member of the executive committee of the American Electric Railway Transportation & Traffic Association, chairman of the committee on rush-hour service, chairman of the committee on definitions, member for four terms and then chairman of the committee on fares and transfers and member of the standards committee. These activities have also given him a wide acquaintance among railway men.

Mr. Sullivan was born in Chicago on Nov. 1, 1878. He was graduated from Notre Dame University in 1897 and then spent seven years in newspaper work in Chicago. His railway experience began in 1904, when he became connected with the traction companies operating on the north and west sides of Chicago, the predecessors of the Chicago Railways, as general passenger agent. He served in this capacity for one year and was then promoted to the position of general supervisor, which he held until the operating consolidation of the Chicago Railways and the Chicago City Railway in 1914, to form the Chicago Surface Lines. Since that time he has been statistician of the combined companies.

Mr. Wood Heads Pacific Railway Club

At its annual meeting, held in San Francisco, Cal., on March 16, the Pacific Railway Club elected the following officers for the ensuing year:

President, Dennistoun Wood, assistant mechanical engineer and engineer of tests of the Southern Pacific Company; first vice-president, G. H. Harris, general superintendent of the San Francisco-Oakland Terminal Railways; second vice-president, F. S. Foote, Jr., professor of railroad engineering at the University of California; treasurer, G. H. Baker, assistant general freight agent of the Atchison, Topeka & Santa Fe Railway; secretary, W. S. Wollner, general safety and welfare agent of the Northwestern Pacific Railroad.

Following the election of officers, Samuel O. Dunn, editor of the *Railway Age*, delivered an address on "The Future of the Railroads."

C. H. Crooks, general manager of the Fort Dodge, Des Moines & Southern Railroad, Boone, Iowa, has been elected president of the company. Mr. Crooks will continue to act as general manager in addition to discharging the duties of president.

Gordon Campbell has been elected president of the Western New York & Pennsylvania Traction Company, Olean, N. Y., to succeed Wilson R. Page, resigned. Mr. Campbell is the representative of Day & Zimmerman, who will operate and manage the local properties. He is president of the York (Pa.) Railways.

Wilson R. Page has resigned as president of the Western New York & Pennsylvania Traction Company, Olean, N. Y., effective from April 1, when the management of the property was taken over by Day & Zimmerman. The company operates the Olean local lines and interurban lines from Olean to Rock City, Salamanca, Bradford and Little Valley.

Mr. Mortimer Resigns

During His Ten Years as Vice-President and President North American Company Net Earnings Have Nearly Trebled

James D. Mortimer, who has been connected with the North American Company for more than ten years, first as vice-president and for six years as president, has resigned, the resignation to become effective Nov. 1, 1920. He succeeded James Campbell as president in 1914. Mr. Campbell thereupon became chairman of the board of directors, but died a few months later.

Earning Capacity Early Visualized

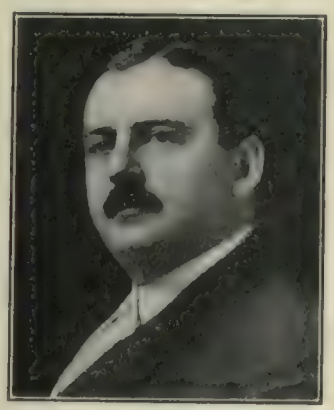
Mr. Mortimer's career with the North American Company has been marked by loyalty to Mr. Campbell and his policies, as well as by a spirit of original progressiveness which has kept him on the front line of utility progress. Within two months of the date of his taking the North American vice-presidency Mr. Mortimer stated to Mr. Campbell that the company was capable of earning 10 per cent on its stock instead of the 4 per cent or so which it was then earning. That goal, which to others then seemed remote, has been reached in ten years, as for the twelve months ended Feb. 29 the net income was practically 10 per cent, after reaching 8.54 per cent in 1918.

Mr. Mortimer has always been willing to break away from the beaten paths in utility development, as is illustrated by a number of conspicuous events of his administration. For example, the zone system of fare collection appealed to him as rational as early as 1911 and three years later it was applied in Milwaukee and vicinity, with the result that now in that city riders are paying fares which have a relation to the length of ride, excepting in the central area. He also early advocated the use of trailers to increase car unit capacity at times. More important still he applied the principle of metering the effect of labor, leading to the development of a new system of wages providing additional compensation in accordance with productivity. This was first applied in the Cold Spring shops at Milwaukee, and gradually extended to the power plant, to the transportation and accounting departments and to the linemen. It is now the ruling plan in substantially all departments of all of the companies underlying the parent organization.

Real Co-operation With Labor

In his efforts to co-ordinate the interests of employees and employer Mr. Mortimer applied in 1915 in the transportation department at Milwaukee a system of review by the employees of penalties imposed upon trainmen as part of the general scheme of wage conferences, all interwoven with the plan of bonus wages and bonus committees. This led naturally to the general labor contract with the Employees' Mutual Benefit Association and to collective bargaining and responsibility with the labor adjustment committee elected in each department by the employees. The E. M. B. A., which was organized in Wisconsin in February, 1912, and later on the other properties, operates as a fraternal industrial union. Its membership includes all of the permanent employees of the subsidiary companies. The activities of the association have since greatly expanded. In 1914 the E. M. B. Savings & Loan Association was organized and the employees of the subsidiary companies have subscribed for nearly $5,000,000 of its stock.

Mr. Mortimer was also one of the first to call the attention of the industry and others to the unprofitableness of the electric railway business. Much of his work as chairman of the program committee of the American



J. D. MORTIMER

Electric Railway Association has been along these lines, including his advocacy of an attitude on the part of electric railways favorable to municipal ownership as best for the railways although not for the public.

This last statement brings us to Mr. Mortimer's great interest in what may be termed mass psychology. This, his experience shows, is a most important factor in getting results. His studies, for example, as to the psychological side of car riding, of the reaction secured from public addresses by utility officials, etc., illustrate this interest. As to car riding, the report prepared for the association by F. W. Doolittle, under Mr. Mortimer's direction as chairman of the committee on cost of transportation service, contains tangible evidence of the importance of getting a proper reaction from the people. In public addresses, also, he has proved it to be highly important for the speaker to know what interpretation will be put upon his remarks.

But most important of all, in many ways, of the duties which Mr. Mortimer has been called upon to perform are those relating to finance. He discovered a stratum of investors in public utility securities that had not previously been reached. More than 3,600 customers of the Union Electric Light & Power Company have purchased $2,668,200 of its preferred stock, and more than 6,000 investors in the territories that are served by the Milwaukee Electric Railway & Light Company and Wisconsin Gas & Electric Company have purchased notes of the former and notes and preferred stock of the latter. Through his personal contact with utilities controlled by the North American Company he succeeded in producing some interesting results as follows:

After All, Money Talks

In ten years the Wisconsin subsidiaries increased their gross earnings by $12,203,000, with a corresponding plant and property account increase of $19,226,000, or $1.67 for each dollar of increased gross earnings. For the Missouri group (omitting the United Railways, St. Louis) the corresponding figures were $5,596,000 and $10,770,000, or $1.92 per dollar. In Wisconsin the reserve and surplus, after providing for dividends and maintenance of physical property, increased from $4,592,000 to $11,543,000. In 1909 the railway utilities produced a substantial part of the gross income of subsidiaries, but in 1919 the gross income from such utilities was less than 22 per cent of that of the subsidiaries and their operating revenues were less than 29 per cent.

Mr. Mortimer's early observation of the trend of operating expenses resulted in practically the first applications to regulatory bodies for relief, and his advocacy of automatic regulation marked an epoch in all public utility industries which may soon be expected to bear fruit.

In all of the above results Mr. Mortimer gives great credit to the men by whom he has been surrounded, and for whose welfare he has constantly striven. As a college man he has appreciated the value of technical and classical training. Twenty years ago he graduated as honor man from the University of California. After teaching for a year he served as an engineer with several utility properties, reaching his present position as a result of his contact with Mr. Campbell, who was president of the Telluride Power Company when Mr. Mortimer was an officer of the Electric Bond & Share Company.

Active in Association Councils

Mr. Mortimer has labored diligently in behalf of the public utility industry in many ways, and his advice is always valued highly in the councils of the American Association which has been the vehicle for some of his best work. The most extended researches which have been conducted under his direction were those embodied in the reports to the American Association on cost of transportation service (1915) and on social relations (1917). With such an established record for initiative, progressiveness and administrative and financial ability it seems incredible that Mr. Mortimer is only forty years of age.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Credits in Railway Field Improving

Railways Commencing to Find Themselves After a Hard Winter—Manufacturers Cautious

Credits in the railway field are fair, and are believed to be improving gradually.

Manufacturers generally are cautious in regard to credit but have been liberal with the railways and helpful within reason. Of course, the management, past performance and prospects of the railway are taken into consideration before any extensions are permitted, but on the whole manufacturers and supply houses have been quite lenient during the past winter.

In virtually every section of the country collections are not in such good condition as they were at the first of the year. There has been no radical falling off in the situation, but just enough lengthening of collection time to cause considerable care in financial matters to be exercised. Money is not so free as it was and in some cases is tight. Call money is high. Early this week call money in New York was 12 per cent, following a renewal rate of 8 per cent. Time money is 8 to 8½ per cent. Actual need of cash, high loan rates, reduced income on account of bad weather during January, February and March and income-tax payments are given as causes for the general slowing up of collections.

Snow Plow Deliveries Five to Seven Months

Steel Plate Scarcity and Uncertainties in Lumber Market Add to Difficulties of Builders

Railways are rapidly coming into the market at this time for snow plows and sweepers. A number of inquiries have been received by different snow-plow and sweeper manufacturers and a total of seven equipments are reported as purchased during the past two weeks.

A large number of railways whose experiences with the snow storms of the past winter are still fresh in mind already have included allowances in their budgets for different kinds of snow-removal equipment. In addition, purchases since the beginning of the war of this type of equipment have been exceedingly small, so from all indications, the year 1920 will be a record-breaker as far as the purchase of snow-plows and sweepers is concerned.

Owing to the length of deliveries on steel plates for making nose plows, shear plows, flangers and scrapers, the builders are unable to quote less than five to seven months delivery.

Lumber is also hard to obtain and shipments have been held up entirely too long.

Deliveries on rotary plows and on short or long-broom sweepers are not much better than for the above types. Motors and control equipment will hold up shipments if nothing else interferes, as deliveries are now from four to six months on that equipment.

With the railways counting up their losses from the lack of proper snow-removal equipment, and with the report that Boston Elevated Railway has placed orders for from four to six snow-plows and sweepers, interest by both railway men and manufacturers will be focussed on this situation.

Heater Parts to Be Ordered Months Ahead

Extended Deliveries Force Railways This Year to Place Requirements Early

Lack of labor and raw material at the potteries, coupled with an unprecedented demand, has caused a shortage of hollow ware.

Deliveries are lengthening, with the result that electric railway heater manufacturers are experiencing great difficulties in making shipments.

Because of the scarcity of hollowware, large electrical manufacturers of stoves, ranges, sockets, insulators, etc., now are attempting to buy entire pottery factories in order to keep pace with production in their own plants. If they are successful, it will decrease the amount of hollowware available for electric railway heater purposes and cause additional delays in shipments.

Heretofore, railways have purchased heater parts during August and September for sixty to ninety days delivery. Under present conditions, with four months the best delivery that electric railway heater manufacturers can obtain on hollowware and with other porcelain and hollowware factories in the electrical industry on a six to eight months' delivery basis, it is plain to be seen that electric railways which expect to install heater parts next fall and winter must place their orders now for shipment as soon after Sept. 1 as the orders can be filled.

Inability of electric railway heater manufacturers to place large orders for raw material owing to last minute calls for heater parts has caused a heavy loss both to the manufacturer and to the railway. However, material is purchased anywhere it is obtainable at the best price, which is often double the regular price, and the railway must pay for the increased cost unless the manufacturer is willing to absorb a portion of it. Sheets for making covers are hard to obtain and premiums must be paid in most cases for this material. Shipments of clips, screws, fastenings and miscellaneous parts generally are late and are obtained only with much difficulty.

Orders for heaters to equip approximately 1,000 cars have been placed since Jan. 1, 1920, or are still pending and will be placed within the next few months. This indicates a healthy condition in the electric heater field and is undoubtedly just one more reason why railways which may be in the market for heater parts should act quickly in placing orders.

Mazda Lamps for Railways Marked Up

Increased Factory Production Costs Are Responsible for Advance Over the Prices of October, 1918

New lamp prices have been put into effect by the Mazda lamp manufacturers as of April 1. Increased costs of production on both railway lamps and on the ordinary types have been given by the manufacturers as the reason for the advances, and in this connection greater advances have been placed on frosted lamps than on clear lamps. Complications in the sand blasting have made this process still more costly.

Prices of Mazda "B" lamps where five in series are used on the 525, 550, 575, 600 and 650 volt railway circuits have advanced from 5 to 25 cents on the clear type and from 7 to 18 cents on the frosted variety, depending on the wattage of the lamp. These price changes appear in the accompanying table. The last increase was put into effect Oct. 1, 1918.

MAZDA "B" LAMPS FOR ELECTRIC RAILWAYS

Watts	Prices Clear Old	Prices Clear New	Prices Frosted Old	Prices Frosted New
23	35	40	38	45
36	35	40	38	45
56	40	45	45	50
94	85	1.10	92	1.10

In the common run of lamps used in stations, etc., in the 110 to 125 volt type, the sizes up to 50 watts have increased from 35 to 40 cents clear and 38 to 45 cents frosted. Similar increase on the 60 watt "B" lamps are announced.

Type C lamps such as are used in up

to date car-houses, shops and power-houses, show increases and decreases. The 75-watt has gone from 70 cents to 75 cents clear, and from 75 cents to 80 cents frosted. No change in price has been applied to the clear types in the 100, 750 and 1,000-watt sizes, but frosted lamps have gone up respectively in these three sizes from $1.15 to $1.20, from $6.75 to $6.85 and from $7.75 to $7.90. On the other hand, the 150-watt C has decreased from $1.65 frosted, the 200-watt from $2.20 to $2.10 clear and from $2.27 to $2.25 frosted. The 300-watt has decreased from $3.25 to $3.15 clear, and the 500-watt from $4.70 to $4.60 clear, while their prices, frosted, have not changed.

Heavy Demand for Railway Motors

Large Sales for Safety Cars With Number of Heavier Types Ordered Rapidly Increasing

Deliveries for large orders of rolling stock of all kinds now are dependent largely on motor shipments. For safety cars, these range from three to four months on a moderate sized order and from four to five months on large orders. Demand has been excellent and the large motor manufacturers are well satisfied with the volume of motor orders received so far this year for safety cars.

Orders for the heavier types of motors are rapidly increasing and with a number of double-truck car orders for large cities pending, sales are expected to show a healthy increase within the next sixty days.

Shipments of the larger sized motors are now being made in from six to eight months, and manufacturers are adding to their shop facilities to take care of the increasing demand.

Bond Prices Decrease

Owing to a recent recession in the copper market, the discount on rail bonds has been revised. Where formerly the old discount was 12½ per cent off list, the new one is 17½ per cent. Other copper products are not affected at this time for the reason that changes in discounts have been announced previously in most instances.

Preparations for spring bonding work are rapidly progressing and many railways have placed requirements for bonds, terminals, pins and for bond wire. Orders are still being received and within another six weeks it is expected that new bonding and repairing of old track circuits will be fairly under way.

Merger of Two Prominent Engineering Firms Effected

The plan for the merger of Westinghouse, Church, Kerr & Company, Inc., with Dwight P. Robinson & Company, Inc., was declared operative on March 18. Dwight P. Robinson has been elected president of Westinghouse, Church, Kerr & Company pending final completion of the merger.

It was stated at the office of Dwight P. Robinson & Company that the Westinghouse Electric & Manufacturing Company, the largest stockholder of Westinghouse, Church, Kerr & Company, will withdraw as a stockholder from the new company and that Guy E. Tripp will remain as chairman of the board of Westinghouse, Church, Kerr & Company only until the organization of the new company is completed.

Details of the new organization have not been fully worked out, but it was stated at the office of Dwight P. Robinson & Company that it is planned to retain the personnel of both of the merging companies. The new company will have an engineering office in the Grand Central Palace, New York City, and the present office of Dwight P. Robinson & Company, at 61 Broadway, will also be retained.

Rolling Stock

Newport & Providence Railway, Newport, R. I., has placed an order recently for two safety cars.

Saginaw-Bay City Railway, Bay City, Mich., is reported to have placed an order for seventeen safety cars.

Cincinnati, Milford & Blanchester Traction Company, Cincinnati, Ohio, is reported to have placed an order for three safety cars.

Boston (Mass.) Elevated Railway is reported to have increased its order of forty elevated cars, which was placed with the Pressed Steel Car Company as noted in the March 13 issue of the ELECTRIC RAILWAY JOURNAL. Twenty-six additional cars of the same type have been placed with this company.

Franchises

Los Angeles (Cal.) Railway.—The Los Angeles City Council has passed an ordinance authorizing the Los Angeles Railway to abandon its franchise for Pico and Eleventh Streets from Broadway to Main Street.

NEW YORK METAL MARKET PRICES

	March 3, 1920	April 1, 1920
Copper, ingots, cents per lb	18 37	18 50
Copper wire base, cents per lb	22.25	22 25
Lead, cents per lb	8 75	9 25
Nickel, cents per lb	45.00	45 00
Spelter, cents per lb	9 10	8 70
Tin, cents per lb	61 50	63 75
Aluminum, 98 to 99 per cent, cents per lb	33 00	33 00

OLD METAL PRICES—NEW YORK

Heavy copper, cents per lb	17 00 to 17 50	16 50 to 17 00
Light copper, cents per lb	14.75 to 15.25	14.25 to 14.50
Heavy brass, cents per lb	9 50 to 10 25	9 75 to 10 25
Zinc, cents per lb	5.00 to 5.25	5.00 to 5.25
Yellow brass, cents per lb	9 00 to 9 25	9 00 to 9 25
Lead, heavy, cents per lb	7.50 to 7.75	7.75 to 7.87
Steel car axles, Chicago, per net ton	33.00 to 35.00	35.00 to 36.00
Old carwheels, Chicago, per gross ton	41 00 to 42 00	39.00 to 40 00
Steel rails (scrap), Chicago, per gross ton	30 00 to 31 00	30 50 to 31 00
Steel rails (relaying), Chicago, gross ton	34.00 to 35 00	34.00 to 35 00
Machine shop turnings, Chicago, net ton	17 50 to 18 00	16 50 to 17 50

ELECTRIC RAILWAY MATERIAL PRICES

Rubber-covered wire base, New York, cents per lb	30 00	30 00
Weatherproof wire (100 lb. lots), cents per lb	27.00	30.00 to 47.00
T-rails (A. S. C. E standard), per gross ton	$55 00 to $57 00	$55.00 to $57 00
T-rails (A. S. C. E. standard), 20 to 500 ton lots, per gross ton	55.00 to 57.00	55 00 to 57 00
T-rails, (A. S. C. E. standard), 500 ton lots, per gross ton*	45.00 to 47.00	45 00 to 47.00
T-rail, high (Shanghai), cents per lb	3.00	3.00
Rails, girder (grooved), cents per lb	3.00	3.00
Wire nails, Pittsburgh, cents per lb	4.00	4.00
Railroad spikes, drive, Pittsburgh base, cents per lb	3 35 to 3 85	3 35 to 3 85
Railroad spikes, screw, Pittsburgh base, cents per lb	7.50 to 9.00	7.50 to 9 00
Tie plates (flat type), cents per lb	3.00	3.00 to 4 00
Tie plates (brace type), cents per lb	3.00	3.00 to 4.00

ELECTRIC RAILWAY MATERIAL PRICES

	March 3, 1920	April 1, 1920
Tie rods, Pittsburgh base, cents per lb.	7.00	3.50 to 4.25
Fish plates, cents per lb	3.00	3.50 to 4.25
Angle plates, cents per lb	3.90	2.75 to 4.00
Angle bars, cents per lb	3.90	2.75 to 4.00
Rail bolts and nuts, Pittsburgh base, cents per lb	4.50 to 6.50	4.50 to 6.50
Steel bars, Pittsburgh, cents per lb	3 00 to 4.00	3.00 to 5.00
Sheet iron, black (24 gage), Pittsburgh, cents per lb	4.50 to 7.50	5.00 to 8.00
Sheet iron, galvanized (24 gage), Pittsburgh, cents per lb	6.00 to 8.00	6.27 to 8.27
Galvanized barbed wire, Pittsburgh, cents per lb	4.60	4.60
Galvanized wire, ordinary, Pittsburgh, cents per lb	4.20	4.20
Car window glass (single strength), first three brackets, A quality, New York, discount †	77%	77%
Car window glass (single strength), first three brackets, B quality, New York, discount	77%	77%
Car window glass (double strength, all sizes AA quality), New York, discount	79%	79%
Waste, wool (according to grade), cents per lb	29 to 32	24 to 29
Waste, cotton (100 lb. bale), cents per lb	16 to 17	18
Asphalt, hot (150 tons minimum), per ton delivered	.....	....
Asphalt, cold (150 tons minimum, pkgs. weighed in), per ton	25.00	32 00
Asphalt filler, per ton	30.00	30.00
Cement (carload lots), New York, per bbl	2.90	2.80
Cement (carload lots), Chicago, per bbl.	2.00	2 00
Linseed oil (raw, 5 bbl. lots), New York per gal	1.80	1.77
Linseed oil (boiled, 5 bbl. lots), New York, per gal	1.82	1.79
White lead, (100 lb. keg), New York, cents per lb	14½	15½
Turpentine (bbl. lots), New York, cents per gal	1.99	2.16 to 2.36

*U. S. Steel Corp.

†These prices are f.o.b. works, with boxing charges extra.

Inspiration Consolidated Copper Company, Globe, Ariz.—The board of supervisors of Gila County, Ariz., has granted T. A. Donahue, general manager of the Inspiration Consolidated Copper Company, a franchise to build and operate an electric railway line between Globe and Miami.

Recent Incorporations

Cleveland & Sharon Rapid Transit Company, Youngstown, Ohio.—The Cleveland & Sharon Rapid Transit Company has been organized for the purpose of building an interurban line between Youngstown and Warren, Ohio, passing through McDonald and Niles.

Northern Neck Railway & Power Company, Fredericksburg, Va.—Application has been filed with the State Corporation Commission for a charter for the Northern Neck Railway & Power Company, which proposes to build an electric railway 100 miles long from Fredericksburg to a point on the Rappahannock River. The company is capitalized at $5,000,000. Its officers are: Willis H. Fowler, president; G. D. Happer, vice-president, and M. Glennon, secretary, all of Norfolk.

Track and Roadway

Pacific Electric Railway, Los Angeles, Cal.—The Pacific Electric Railway has secured a permit to extend its Long Beach freight line from Third Street to Ocean Avenue, Long Beach.

Twin City Rapid Transit Company, Minneapolis, Minn.—The Twin City Rapid Transit Company has placed orders for rails, ties and other equipment for the construction of a line in North Seventh Street and loop trackage in the downtown district of Minneapolis.

Salem & Penns Grove Traction Company, Penns Grove, N. J.—A committee of the Chamber of Commerce of Quinton, N. J., has secured a right of way for a proposed extension of the line of the Salem & Penns Grove Traction Company from Salem to Quinton. The extension would be three miles in length.

Cincinnati (Ohio) Traction Company.—The Cincinnati Traction Company recently notified W. C. Culkins, street railway director, that the cost of changing the present double trolley system in Cincinnati to a single trolley system would amount to $523,550. The value of the salvage was estimated at $353,000, making the net cost approximately $170,000.

Milwaukee Electric Railway & Light Company, Milwaukee, Wis.—The Milwaukee Electric Railway & Light Company has ordered 1,000 ties each from the International Steel Tie Company and the Dayton Mechanical Tie Company, for installation in track reconstruction this summer.

Trade Notes

Mono Corporation of America, Buffalo, N. Y., announces that it has purchased the entire stock of Mono apparatus and accessories from the F. D. Harger Company, Buffalo, N. Y.

Trolley Supply Company, Massilon, Ohio, has moved its factory from Canton to Massilon, where the company recently built a new plant for the manufacture of railway supplies. According to F. E. McLain, president of the company, the move was made March 22.

Western Electric Company, New York, N. Y., on March 8 to 12, held its first general conference in five years at the Hotel Chalfonte, Atlantic City, N. J. Managers and sales managers of the company's forty-five distributing houses and executives from the main New York office were present. F. A. Ketcham, general sales manager, acted as presiding officer of the conference, the keynote of which was "A Larger and More Profitable Business."

Rail Welding & Bonding Company, Cleveland, Ohio, formerly the Lincoln Bonding Company, has moved its factory and offices from 634-36 Huron Road to 2336-2400 Woodland Avenue, where it has purchased a large four story building with a two story annex. With this floor space and a large amount of additional equipment this company is making every effort to meet the greatly increased demand for its products.

A. T. Shurick, recently of the business staff of the *Coal Trade Journal*, has been elected vice-president of F. C. Thornley & Company, consulting and constructing engineers, New York. This firm has been identified with the development and construction of some of the largest coal handling and storage installations in the country, such as the Curtis Bay piers of the B. & O. Railroad, and designs, constructs and prepares for operation plants of this character as well as doing other engineering work.

Eastern Asbestos Company, Providence, R. I., has been established with offices at 417 Grosvenor Building, and the company will sell both standard and special asbestos products, including yarn, tape, cord, cloth, twine, listing, gaskets, carded fiber, gasket cloth, friction disks, sheet and high-pressure packing. P. O. Baker, who has been in the electrical industry for the last eighteen years, is manager. Mr. Baker has just resigned as purchasing agent of the D & W Fuse Company, Providence, and was formerly employed by the Western Electric and Simplex Wire & Cable companies.

Curtain Supply Company, Chicago, Ill., has taken over the manufacture and sale of the steam and electric railway articles formerly manufactured and sold by the Forsyth Brothers Company, Harvey, Ill. Among the articles taken over are the metal sash, weather strips, screens, deck sash ratchets, etc. It is planned to market these products henceforth under the regular trademark name of the Curtain Supply Company, namely "Rex." The company is increasing its plant capacity at 350 West Ontario St. to take care of this additional volume of business in order that it will be in a better position to make delivery on the large number of orders which it already has on its books.

Chicago Pneumatic Tool Company, Chicago, Ill., effective March 31, has moved its general offices to New York and will occupy a new ten story structure erected for exclusive use of the company at 6 East 44th Street, New York. The Chicago district sales branch, previously in the Fisher building, has been moved to commodious new quarters on Chicago's new Boulevard link, at 300 North Michigan Boulevard. The service branch, formerly at 521 South Dearborn Street, has been consolidated with the sales branch at the new address, occupying the first floor of the building, while the sales offices will be on the second floor, or boulevard level. J. L. Canby, district manager, will continue in charge of the Chicago office.

Square D Company, Detroit, Mich., manufacturers of electrical safety devices, announces that E. A. Printz, formerly district sales manager at Chicago, has been made sales manager, A. MacLachlan continuing in the capacity of secretary and director of distribution. D. M. Stone, formerly district sales manager of the Pittsburgh trritory, is now in charge of the Detroit territory. J. A. Jaques, formerly district sales manager at New York, was given the Pittsburgh territory, and H. W. Spahn, district sales manager at Buffalo, was placed in charge of New York. D. H. Colcord, formerly of the department of publicity, Westinghouse Air Brake Company, Pittsburgh, Pa., was appointed director of research engineering. The annual sales conference of the company was held at the Hotel Statler, Detroit, February 16, 17 and 18.

New Advertising Literature

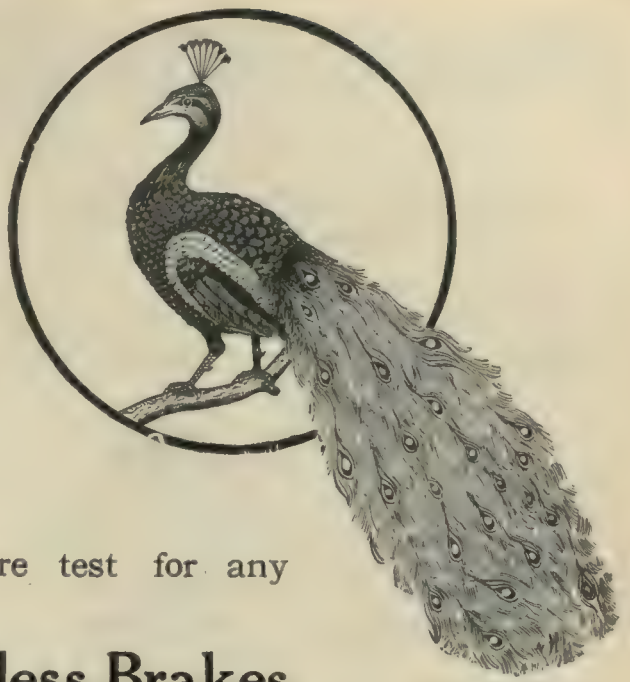
Reading Valve Fittings Company, Reading, Pa.: A catalog of steel and iron flanges and screwed fittings and flanges.

Schweitzer & Conrad, Inc., Chicago, Ill.: Bulletin on farm-service equipment, of interest to electric railway companies furnishing industrial power.

Westinghouse, Church, Kerr & Company, New York City: Bulletin on the "cost plus" plan of doing work, under which this concern has done over $100,000,000 worth of work during the past twenty years.

Gold Car Heating & Lighting Company, New York, N. Y.: Bulletin No. 4 issued January, 1920, on its standardized electric heaters with steel or aluminum cases and equipped with interchangeable heating elements.

Will Your Hand Brakes Stop a Car Weighing 100,000 Lbs. or More?



This is a very severe test for any brake, but—

Peacock Staffless Brakes

are doing it every day on Differential Utility Cars operated on the following lines:



"The Peacock Staffless"

Third Avenue Railway	1 car
Richmond Light & Railroad Co., Staten Island	1 car
York Railways Company	1 car
Boston Elevated Railways	11 cars
Chicago Surface Lines	5 cars
Milwaukee Electric Railway	2 cars
Holyoke Street Railway	2 cars
Springfield Street Railway	1 car
Reading Transit & Light Co.	1 car
East Liverpool Traction & Light Company	1 car
Acme Power Company (Toledo Rys. & Lt. Co.)	1 car

This speaks for itself and should convince you that where brake power is needed

Peacock Brakes Should Be Specified

National Brake Company, Inc.

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Buffalo, N. Y.

Bankers and Engineers

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Engineers.
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Industrial Plants and Buildings. Steam Power Stations. Water Power Developments. Substations. Gas Plants. Transmission Lines. Electric and Steam Railroad Work.
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CONSULTING ENGINEER
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AMERICAN BRIDGE COMPANY
HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS

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Boston, Mass.	John Hancock Building	Salt Lake City, Utah	Walker Bank Building
Baltimore, Md.	Continental Trust Building	Duluth, Minn.	Wolvin Building
PITTSBURGH, PA.	Frick Building	Minneapolis, Minn.	7th Ave. & 2nd St., S. E.
Buffalo, N. Y.	Marine National Bank		
Cincinnati, Ohio	Union Trust Building	*Pacific Coast Representative:*	
Atlanta, Ga.	Candler Building	*U. S. Steel Products Co., Pacific Coast Dept.*	
Cleveland, Ohio	Guardian Building	San Francisco, Cal.	Rialto Building
Detroit, Mich.	Beecher Ave. & M. C. R. R.	Portland, Ore.	Selling Building
CHICAGO, ILL.	208 South La Salle Street	Seattle, Wash.	4th Ave. So., Cor. Conn. St.

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THE COAL & IRON NATIONAL BANK
of the City of New York

Capital $1,500,000
Surplus $1,000,000 Und. Profits $363,051
Resources $23,743,000

Offers to dealers every facility of a New York Clearing House Bank.

Scofield Engineering Co. Consulting Engineers PHILADELPHIA, PA.
POWER STATIONS GAS WORKS
HYDRAULIC DEVELOPMENTS ELECTRIC RAILWAYS

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SARGENT & LUNDY, *Engineers*
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ELECTRICAL TESTING LABORATORIES
Electrical, Photometrical and Mechanical Testing.
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THE P. EDW. WISH SERVICE
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ROEBLING
Messenger Trolley
and
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on the
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Trenton, N. J.

New York Boston Chicago Philadelphia Pittsburgh
Cleveland Atlanta San Francisco Los Angeles
Seattle Portland, Ore.



Type R-10—Single Register

For Fare Registers Consult "International"

Registers for many conditions and classes of service are made by The International Register Co. All are quality instruments, properly designed and built for accurate registration, and long enduring service with minimum repairs or replacements.

To handle present day changes in fares, with complete protection for Company, conductor and passenger, an effective system of checking load against receipts is necessary.

Accurate visible and audible registration at the time fare is received provides an adequate system for immediately meeting any change in fare, without any change in collection methods or equipment.

The effectiveness and adaptability of International Registers has been proven on leading Electric Railway and City systems throughout the country.



Type R-5—Double Register

The International Register Company

Manufacturers of Fare Registers and Railway Supplies, and General Selling Agents for HEEREN ENAMEL BADGES

Office and Factory: 15 So. Throop St., Chicago, Illinois

Lubricating methods that are successful on another property may be harmful on yours. Rely only on individual lubricating service

YOU wouldn't have much confidence in a physician who wrote a blanket prescription for one hundred patients after diagnosing one case. And you wouldn't look for speedy recovery on the part of those who paid for his services.

The same thing applies to "sick" lubricating methods. A stock remedy can't cure the troubles of one hundred different properties any more than a doctor's blanket prescription can cure one hundred different patients. The physical characteristics of every electric railroad vary to such a great extent that the only true remedy for faulty lubrication is *individual lubricating service.*

Lubricating service can be classed as individual only when each property to which it is applied is considered as an individual unit, requiring a lubricant and lubricating methods different from those used on all other properties.

It is not safe to assume that what is beneficial on one road will be beneficial on another, even tho the physical characteristics of both are apparently the same. There are innumerable examples which show how this method of procedure has often resulted in an actual lowering of operating efficiency.

The lubricating service offered by the manufacturer of Tulc is individual in every sense of the word. When we are called upon to improve lubricating methods and decrease lubricating costs on a certain property our calculations are based on the requirements of the property under consideration—not upon what we have done in the past. Our broad experience in this field and the valuable data which we have acquired in solving similar problems for other roads is helpful, of course, but only insofar as it can be applied in a general way. We have no fixed policies which must be rigidly adhered to. Our service is flexible. That's why it's *individual* and why it can be applied to so many dissimilar properties with consistent, money-saving results.

We are in a position to offer this service to a few more properties and will be glad to hear from executives to whom it will be helpful.

Example No. 3

Said one car shop foreman of Tulc, "Since using Tulc our armature changes have dropped from 180 to 130 and armature pinions from 139 to 97. In other words 49% of the pinions were removed when Tulc was used as compared with 70% before. I am certainly surprised at results like this."

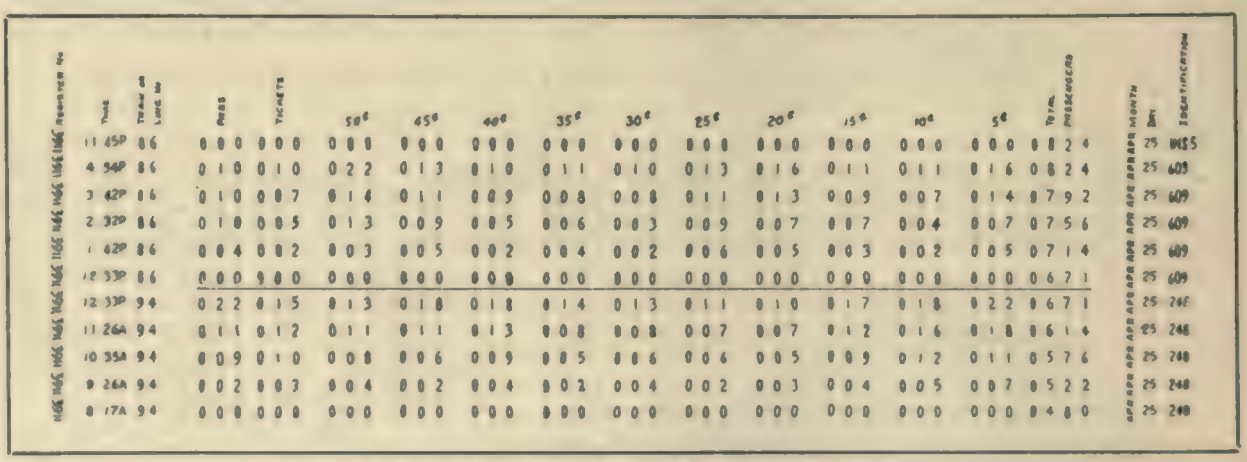
The Universal Lubricating Company
Cleveland, Ohio.
Factory Sweeney Avenue — Office Schofield Bldg.

TULC + Universal Service

Accurate Information

is a fundamental requirement in any business. The money earned, as well as the money spent, must be carefully itemized.

Each fare collected in your cars should be separately indicated, classified, and an unalterable record made at the time and at the place the transaction occurs, *or you are not building on solid ground.*



A Record from a No. 52 Type Ohmer Fare Register

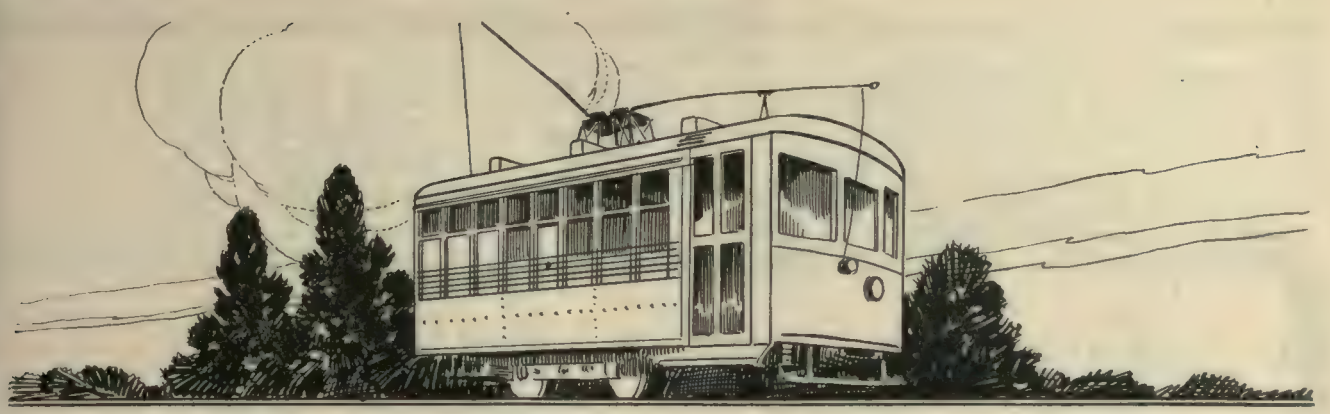
The *Ohmer System* provides complete, printed records of every detail of business done. These records are so clear and compact that the itemized information is at once available for statistical purposes, and by a quick method of analysis, which is a part of the Ohmer System, the characteristic tendencies of each conductor are so revealed that thoroughly effective discipline, based on absolute knowledge of the facts, can be applied.

The Ohmer System not only furnishes accurate and complete records, but it also enforces honest service in the only practical way, *by making it worth while* for the conductors to be honest and efficient.

Give us an opportunity to tell you just what the Ohmer System really is. You will be interested because it deals with vital facts.

Ohmer Fare Register Company

Dayton, Ohio

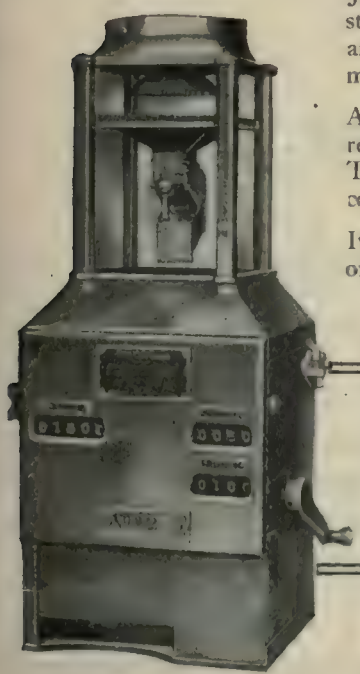


The nickels and dimes on your cars are as valuable as those in your cashier's office. Safeguard them with the same care.

Every dollar turned over to your cashiers is accounted for at the end of the month. Each quarter, dime and nickel is safeguarded by modern accounting methods. If receipts and balances vary by so much as a copper cent you want to know the reason why. All of which is right and necessary if you are to continue to sell transportation to the public. For the same reason the cash on your cars should be protected with the same accuracy that prevails in your counting room. There's no economy in stopping leaks at the spigot and then allowing profits to escape thru the bung hole.



Insure modern accounting methods on all your cars by installing JOHNSON FARE BOXES



Johnson Fare Boxes stop the leaks that impair the morale of your conductors. They stop the leaks that reduce profit. They put on each car so equipped, the same accurate and constant check on receipts that prevails in your accounting department. They make it easy to keep the honest conductor and get rid of the dishonest one.

And hard service under the most trying conditions has proved the Johnson Fare Box reliable and efficient. Johnson Fare Boxes used in connection with Johnson Metal Tickets make it possible to approach the ideal of every railway operator—100% fare collection.

It's cheaper to install the best first. Let us send you full details showing the flexibility of Johnson Fare Boxes as applied to every form of fare collection. Write today.

JOHNSON FAREBOX CO.

Jackson Boulevard and Robey Street, Chicago

50 East 42nd Street, New York



The Car Card is judged by it's results.

Good car cards keep advertisers satisfied because they produce increased sales.

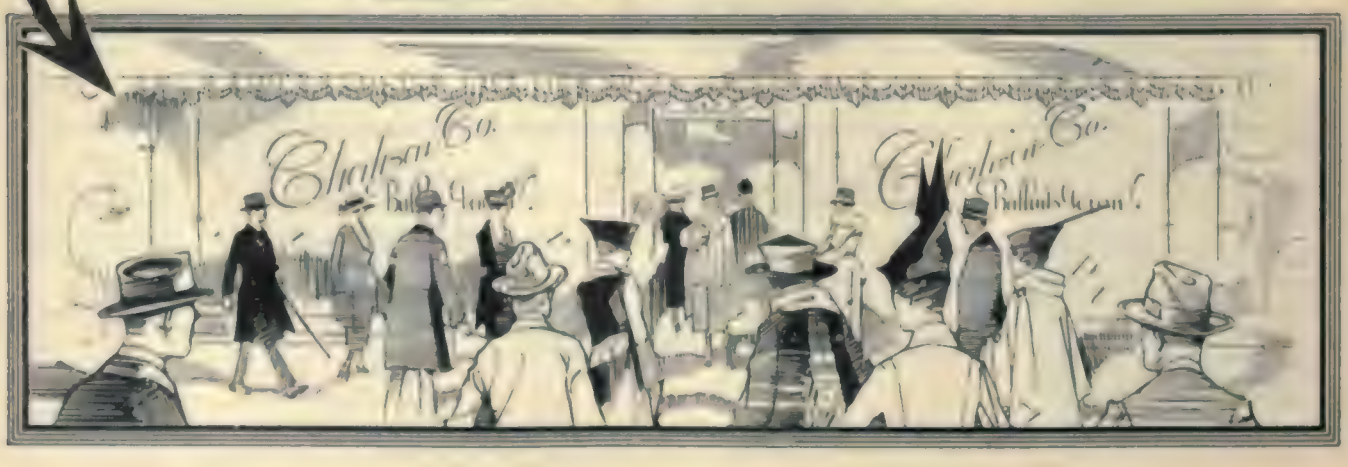
Collier Service

is the concentration of the best advertising ideas and plans applied to car cards.

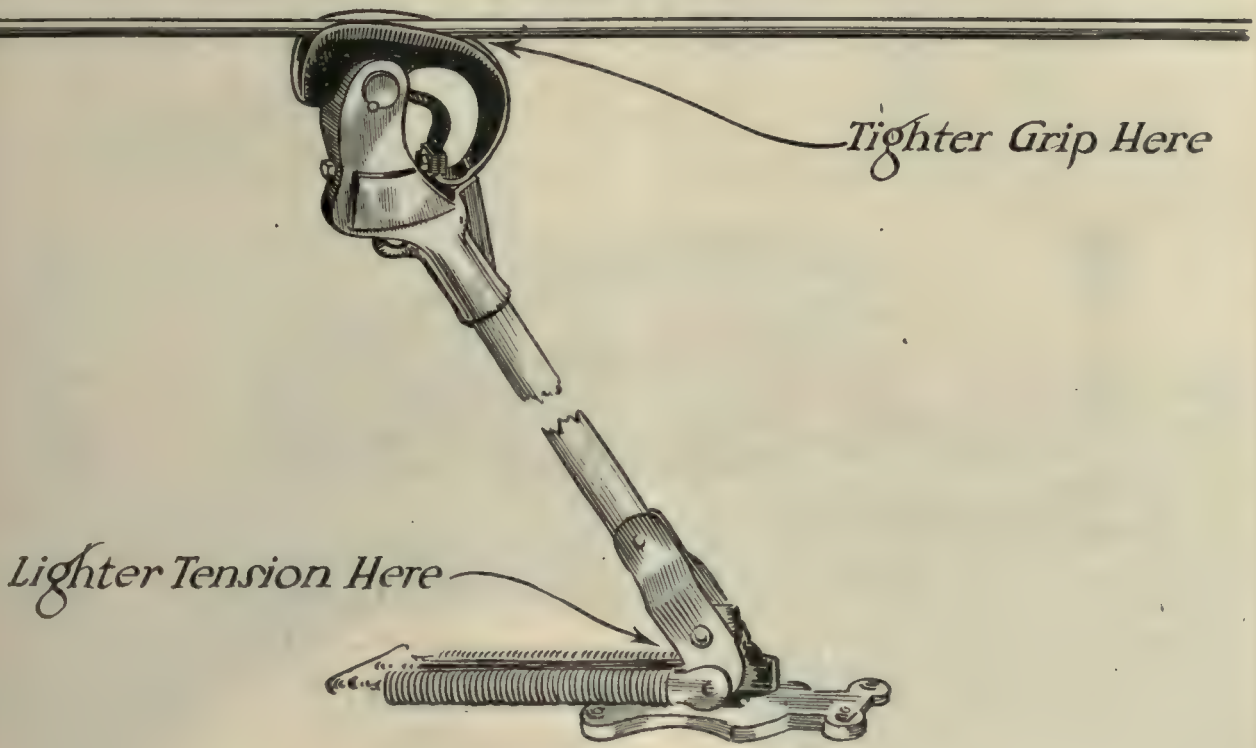
To the electric railway this means a regular monthly check which assures a permanent and steady income. Collier Service is nation wide in scope. It reaches all and serves all

Barron G. Collier
INCORPORATED

Candler Bldg., New York



MILLER TROLLEY SHOES MEAN



It seems absurd to say that a connection takes a tighter grip on the wire and permits of a lesser tension on the base.

But this is true where Miller Trolley Shoes are used because they have such a large contact surface.

Miller Trolley Shoes are always in contact with the wire, at all speeds.

Decreased tension on the base means less wear on the wire. A greater contact surface means better transmission of power.

Miller Trolley Shoe Co., West Newton, Mass.

SPECIAL REPRESENTATIVE: Holden & White, Inc., Chicago

EASTERN REPRESENTATIVE: National Railway Appliance Co., New York

SALES REPRESENTATIVES:

Alfred Connor, Denver, Colo.
T. C. White & Co., St. Louis, Mo.
F. F. Bodler, San Francisco, Calif.
W. M. McClintock, St. Paul, Minn.
S. I. Wailes, Los Angeles, Calif.
W. F. McKenney, Portland, Oregon.



MORE-JONES
BRASS & METAL CO.
ST. LOUIS, MISSOURI



Kithab

The praying wheel is a mechanical appliance used by Lamaist Buddhists for offering prayers.

Slips of paper bearing a manifold repetition of the prayers forming a kithab are wrapped around cylinders. As the wheel revolves these uncoil and the prayer is considered to be offered.

For centuries this wheel was a hand contrivance and worked for the man only as the man worked with it.

Today the water driven type releases the man for other work.

So, you see, permanent blessings are upon the head of the man who has a stream running through his property.

And the same continuous blessing is available to the state in this country through which a power stream flows—now that the Water Power Bill and Morganite brushes have put a better face on power conditions in America.

More power to hydroelectric development.

Morganite

The Morgan Crucible Company, Main Office and Factory: 519 West 38th St., New York

DISTRICT AGENTS:

Lewis & Roth, 13th and Wood Sts., Philadelphia
Electrical Engineering & Mfg. Co., First National Bank Bldg., Pittsburgh
W. R. Hendrey Co., Hoge Bldg., Seattle
Herzog Electric & Engineering Co., 150 Steuart St., San Francisco.
Charles Farnham, I. W. Hellman Bldg., Los Angeles
Railway & Power Engineering Corporation, Ltd., 131 Eastern Ave., Toronto, Ontario, Canada.



Quality Trolley Wheels and Harps

Like all other Columbia products the trolley wheels and trolley harps manufactured by us have as their motto Quality.

Quality first, last and always. This means to our customers that they can be assured the best the market can afford.

Our wheels and harps are made of the very best metals that can be obtained. Special attention has been given to get long wear and good lubrication. This means the elimination of high maintenance and numerous tie ups due to defective trolley harps and wheels.

Let us hear from you. We want to help you.

Columbia Machine Works & Malleable Iron Co.

Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

A. A. GREEN, Sales Mgr.,
50 Church St., N. Y. C.
J. L. WHITTAKER,
141 Milk St., Boston, Mass.
E. ALLISON THORNWELL
1026-7 Atlanta Trust Bldg.,
Atlanta, Ga.
W. McK. WHITE
6712 Cornell Ave., Chicago, Ill.



TOOLS

Armature and axle straighteners
Armature shaft straighteners
Armature buggies and stands
Babbitting molds
Banding and heading machines
Car hoists
Car replacers
Coil taping machines for armature leads
Coil winding machines
Pinion pullers
Pit jacks
Signal or target switches
Tension stands

CAR EQUIPMENT

Armature and axle bearings
Armature and field coils
Bearings (axle and armature)
Brush-holders and brush-holder springs
Brake, door and other handles
Brake forgings, riggings, etc.
Car trimmings
Commutators
Controller handles
Forgings of all kinds
Gear cases (steel or malleable iron)
Grid resistors
Third-rail shoe beams and accessories
Trolley poles (steel) and wheels


WASHINGTON
OREGON
MONTANA
IDAHO
WYOMING
NEVADA
UTAH
COLORADO
CALIFORNIA
ARIZONA
NEW MEXI
N.DAKOTA
S.DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
MICHIGAN
ILLINOIS
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
S.CAROLINA
N.CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE
DOMINION OF CANADA
NOVA SCOTIA
49
The map above shows the location of the 49 foundries in the United States and Canada represented by the Association of Manufacturers of Chilled Car Wheels.
Chicago 3
St Louis 2
Buffalo 4
Pittsburg 2
Cleveland 2
Amherst N.S.
Montreal
Mich. City. Ind.
Louisville.
Mt. Vernon Ill.
Ft Wayne. Ind
Birmingham
Atlanta.
Savannah
Boston
Detroit
St. Paul.
Kansas City. Kan
Denver
Tacoma
Los Angeles
Rochester N.Y.
Sayre. Pa.
Lime Rock. Conn.
Albany.
Toronto.
New Glasgow N.S.
Madison. Ill
Berwick Pa
Huntingdon. W. Va.
Wilmington Del
Houston Tex
Hannibal Mo
Reading Pa
Baltimore
Richmond Va.
Ft William Ont.
St Thomas "
Hamilton "
Ramapo. N.Y.
Marshall. Tex
Capacity
20,000
CHILLED
IRON WHEELS
Per Day
25 Million in Service
Association of Manufacturers
of Chilled Car Wheels
1229 McCormick Bldg. Chicago.

"STANDARD"

Steel Tires

Steel Tired Wheels

Solid Rolled Steel Wheels

O. H. Steel and Malleable Iron Castings

Solid Forged Gear Blanks

Steel Forgings Iron Forgings

Forged and Rolled Steel

Pipe Flanges

Ring Dies

Rings

Roll Shells Steel Springs



"The 'Standard' Brand on your material is an assurance of eventual economy."



STANDARD STEEL WORKS CO.

GENERAL OFFICES:

500 NORTH BROAD ST., PHILADELPHIA, PA.

CHICAGO
ST. LOUIS
HAVANA, CUBA

RICHMOND
SAN FRANCISCO
NEW YORK
MONTEREY, MEX.

MEXICO CITY
LONDON, ENGLAND
PARIS, FRANCE

Headway

Give yourself greater headway in revenue, by giving your passengers less headway with our Light Weight One Man Safety Cars.

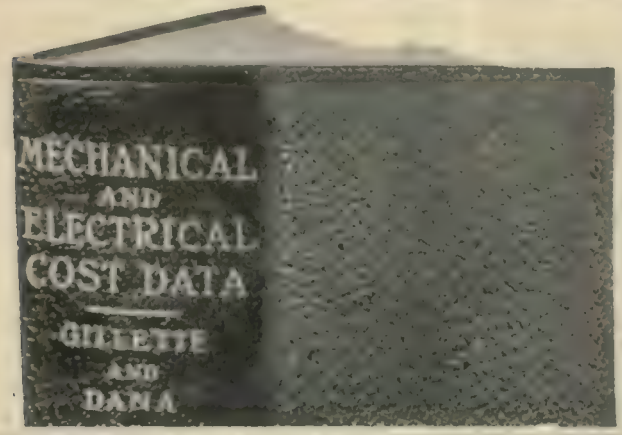
High Speed Schedules, car-in-sight-operation may be Easily obtained if your Safety Cars are built in the Quality Shops.

Quality Products of the Quality Shops.

St Louis Car Company

St Louis Mo.

Gillette and Dana gives you more time for work that counts



Every electrical railway engineer whose estimating and appraising problems consume extra time and effort needs this book. It enables the practising engineer, designer and superintendent to give additional attention to productive work—***work that counts.*** Not merely a book—it is an ever-ready aid that increases the results of the technical man's working day.

Published Setpember, 1918

MECHANICAL AND ELECTRICAL COST DATA

By H. P. Gillette and R. T. Dana

1734 *pages*, 4½ *x* 7, $6.00 *net, postpaid.*

The data in this book consists of actual figures taken from the records of successful engineers. Every detail is carefully itemized and analyzed and so presented as to permit its ready application to your cost finding problems.

The net prices, shipping weights and output of machines and appliances of many types, classes and sizes are given together with installation costs. Reliable information is also included relating to operating expenses, depreciation and other fixed charges, as well as the first cost of a wide variety of plants and plant units.

This data used as a check against your figures will remove the element of risk when making estimates and appraisals. As a time-saver, the book is indispensable.

Examine the book for 10 days FREE

Our on-approval offer permits you to see for yourself, without charge, how useful this book could be to you; there is no obligation to purchase. Why not take advantage of the opportunity? Just send the coupon.

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.,
239 West 39th Street, New York, N. Y.

You may send me on 10 days' approval
Gillette and Dana's Mechanical and Electrical Cost Data, $6.00.
I agree to pay for the book or return it postpaid within 10 days of receipt.
Regular subscriber to the Elec. Ry. Journal?.....
Member of A. I. E. E. or A. E. R. A.?.....

Signed.....
Address.....
Official Position.....
Name of Company.....

(Books sent on approval to retail customers in the U. S. and Canada only). E. J. 3-20

The Great and Particular Value of

CYPRESS

"THE WOOD ETERNAL"

is its **high resistance to decay.** (Specify "All-heart **Tidewater** Cypress"—every piece identified by the above trade-mark as the product of a responsible *Licensed* Assn. Mill.)

The Railway Signal Association has always placed all-heart Cypress among the first choices in the list of suitable woods for

Trunking and Capping

The Railway Signal Association makes its recommendations as a result of definite **knowledge,** and its membership includes many able men who are Cypress enthusiasts. We gladly refer any doubter as to Cypress superiority to any well posted engineer who has had experience with "The Wood Eternal."

The same service conditions which make Cypress superior for "Trunking and Capping" are present in many other railway lumber requirements, such as

Fencing

and similar purposes where the material is exposed constantly to the weather and **high resistance to decay is essential.**

If railway men in general will study the question of wood durability for other uses as carefully as Railway Signal men have studied it there will be a lot more all-heart Cypress used in railway service—**to the very great economy of the companies using it.**

Our data is at your service.

WILL YOU WRITE US? WE WILL REPLY FRANKLY.

Southern Cypress Mfrs.' Assn.

1265 Hibernia Bank Building
New Orleans, La.
or
1265 Heard National Bank Building
Jacksonville, Fla.

Watch Your JOINTS!



Standard for Rubber Cement



OKONITE TAPE
Standard for Splicing Compound

"OKONITE" and "MANSON" TAPE

assure a service of continued and unvarying reliability, and will make your JOINTS *as uniformly strong as your insulated wires.*

OKONITE TAPE is a rubber insulating tape for making splices or joints. Joints properly made with Okonite tape are impervious to moisture and are as strong as or stronger electrically and mechanically than the insulated wire itself.

MANSON TAPE is a rubber filled cloth tape for protecting joints against mechanical injury. It is adhesive, does not unwrap and does not corrode copper wire. Easily handled, economical to use.

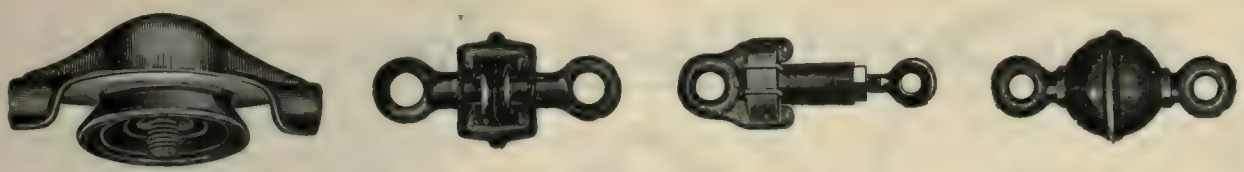


MANSON TAPE
Standard for Friction Tape

Write for our booklet "Economy in Joint-making"

The Okonite Company, Passaic, N. J.
Incorporated 1884

CENTRAL ELECTRIC CO., Chicago, Ill., General Western Agents
F. D. Lawrence Electric Co., Cincinnati, O. Novelty Electric Co., Philadelphia, Pa. Pettingell-Andrews Co., Boston, Mass.



You Can Minimize Overhead Repair Work

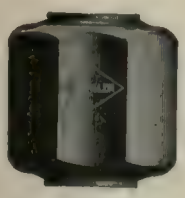
and successfully cut maintenance costs if you turn to

The Macallen Line

of strain insulators, hangers, splicing ears, crossings, and other overhead material.

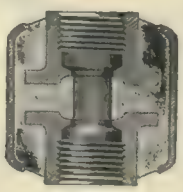
They are "specialty" products, designed and built to make "Macallen" the standard on American railways.

It will pay you to write for information and prices.



The Macallen Insulating Joint

Adopted by principal air brake manufacturers as part of their standard equipment. Also insulates steam pipes, etc. Shell is seamless drawn steel, nipples are machined from steel rod, and insulating material is Macallen Vulcanite Compound, not affected by heat or oil—practically indestructible.



May We Send Our Catalog?

TRADE MACALLEN MARK.

The Macallen Company
Macallen and Foundry Sts., Boston

TRADE MACALLEN MARK.

Victor 7210

for 70,000 Volt Service

This Insulator is built for 70,000 volts. That means you can depend on it to *safely* carry 70,000 Volts because it is a *Victor.*



LOCKE INSULATOR CORP.
Maryland Trust Bldg., Baltimore, Md.

Time Saved Means Money Earned



Your maintenance engineer will tell you that anything that will prove a time saver is valuable.

Not only is an *Anderson Double Take-Up Wood Strain Insulator* a time saver —But a worry-saver, because it is so constructed, that it holds the guy wires securely in place, combining great tensile strength and perfect adjustment, with unlimited insulation.

It cuts the take-up time in half.

Catalog 8 describes it.
Where shall we send yours?

Albert & J. M. Anderson Mfg. Co.

289-293 A Street (Established 1877) **Boston, Mass., U. S. A.**

BRANCHES:
New York, 135 Broadway
Chicago, 105 So. Dearborn Street
Philadelphia, 429 Real Estate Trust Bldg.
London, E. C., 48 Milton Street

He *Can't* Miss It!



It's BIG —and *Reliable*

and can be *seen* so as to give your motormen plenty of time to bring the car to a stop—avoiding what might be a fatal accident at a sharp curve or switch.

U. S. Electric Signals

will be so installed on your road that the first car to reach a cut-in contactor, will have the right of way against opposing cars—preventing side-swiping accidents and providing front and rear protection as well.

"Prevent" instead of "cure." Start now.
Write for particulars.

United States Electric Signal Company
West Newton, Massachusetts

Representatives:
Western: Frank F. Bodler, Monadnock Bldg., San Francisco
Foreign: Forest City Electric Service Supply Company, Salford, Eng.



200 Safety Cars recently ordered by The Brooklyn Rapid Transit Co. will be equipped with

Westinghouse-Krantz Safety Control Panels

Safety Panels For Safety Cars

Each panel is placed above the vestibule window, within easy reach of the motorman, and carries six switches mounted in separate compartments, controlling respectively the car lights, the compressor, the heater, the headlights, the buzzer and the register. N. E. C. fuse connections for each switch are also mounted in individual compartments, which can be opened only when the switch is "off," and all reachable parts are dead.

It is impossible for the motorman to touch live parts when operating the switch.



Krantz Safety Control Panel as Installed

The dimensions of the control panel are:

Length —— 30½ inches
Width —— 10 inches
Depth —— 4½ inches
The weight is 55 lbs.

Westinghouse Electric & Manufacturing Co.
Krantz Works
160 Seventh St., Brooklyn, N. Y.



Easier than Ever to Renew

Economy
Renewable
Fuses

The first renewable fuse using an inexpensive bare renewable link for restoring a blown fuse to its original efficiency to be Approved in all capacities by the Underwriters' Laboratories

—a distinction awarded December 1, 1919, on sheer merit of performance both in the rigid laboratory tests and in actual service in the field, where, for many years, millions of Economy Fuses have been protecting lives—property and electrically driven machinery of all kinds—and effecting marked economies in operating costs.

Easier than ever to renew, because of the winged washer which makes it but the work of a moment to restore a blown fuse. Simply unlock the winged washer, replace the blown Economy "Drop Out" Renewal Link, with a new one, press home the wings of the washer, screw on the end cap and the fuse is securely locked ready for continued service. Simple, easy, economical. No waste of time or money. A supply of Economy "Drop Out" renewal Links cost but little.

Economy renewable Fuses cut annual operating costs 80% as compared with the use of "one-time" fuses.

When you order fuses, simply say **"Economy"**

For sale by all leading jobbers and dealers

ECONOMY FUSE & MFG. CO.
Chicago, U. S. A.

Economy Fuses are also made in Canada at Montreal

In War or Peace Times—

Cut Out the Waste!

Clean up! Do it NOW! Do it regularly!

Every piece of Idle Equipment, Unnecessary Material or Scrap represents WASTE!

—waste

Money!
Time!
Space!
Labor!
Material!

—the *money* such equipment or material cost earns nothing and is not available for other use.

—the *time* it is idle is wasted when it can render service elsewhere.

—the *space* it occupies costs money and may be needed for other purposes.

—the *labor* of its manufacture is wasted and also the labor of producing a duplicate for the man who *can* use it.

—the *material* it represents would be useful in another form.

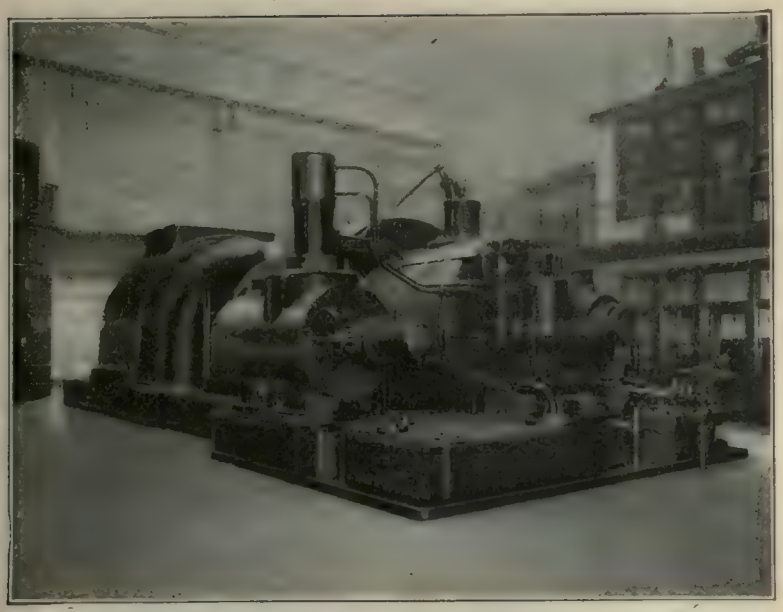
Cut out *all* this waste! Don't have material or equipment around that is not needed. Turn it into cash.

There is always a market for either scrap or good used machinery. Conservation of both materials and machinery can be practiced with just as much profit in peace as in war times.

Buyers for surplus material, good used machinery, junk or scrap, can easily be found through the

Searchlight Section

413



Steam Turbines

Unequalled for

Sustained efficiency and reliability in operation.

Built for

Continuous Service, Durability and Accessibility for Inspection.

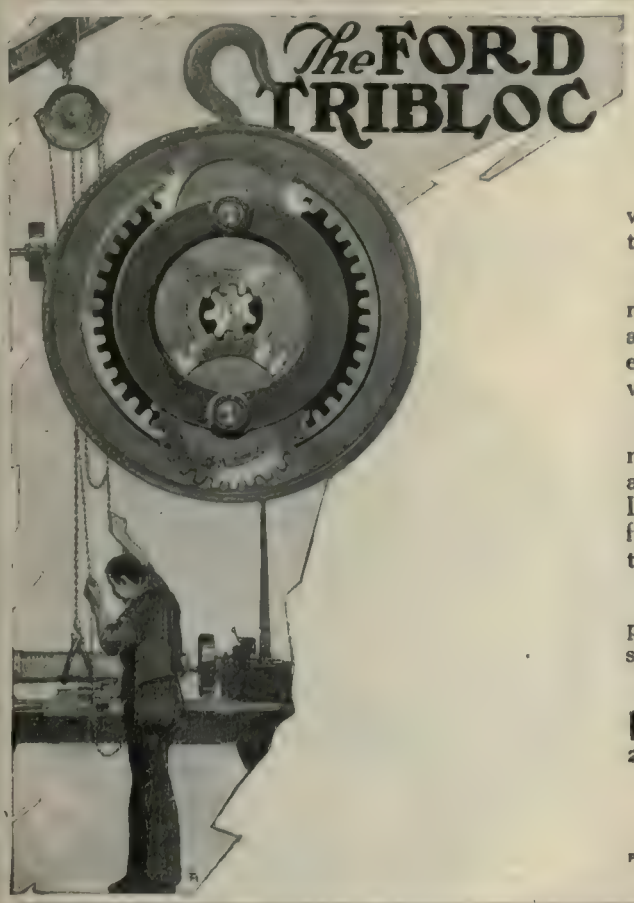
Sizes from 200 kw. up

ALLIS-CHALMERS MANUFACTURING COMPANY

Milwaukee, Wisconsin, U. S. A.

District Offices in All Leading Cities

ALLIS-CHALMERS PRODUCTS
Electrical Machinery
Steam Turbines - Steam Engines
Gas and Oil Engines
Hydraulic Turbines
Crushing and Cement Machinery
Mining Machinery
Flour and Saw Mill Machinery
Power Transmission Machinery
Pumping Engines - Centrifugal Pumps
Steam and Electric Hoists
Air Compressors - Air Brakes
Agricultural Machinery
Condensers



The FORD TRIBLOC

The Planetary System means a balanced drive

A pull on the hand chain turns these steel gears, which deliver the power at two opposite points simultaneously.

Frictional resistance has been reduced to the minimum. 80% of the power applied to the hand chain of a Ford Tribloc is converted into lifting energy. An eighty-two pound pull of one man on the hand chain will lift a ton.

This careful planning and honest construction mean hoist reliability. Carefully tested steel chain and drop-forged steel hooks spell safety. A Patented Loop Hand Chain Guide insures speed of operation for it prevents the hand chain gagging or overriding the flange.

Are we sure? A 5-year guarantee *in writing* accompanies each hoist. Send for our catalog—it tells the story. 2166-D

FORD CHAIN BLOCK CO.
2ND & DIAMOND STREETS PHILADELPHIA, PA.

OVER-SEAS REPRESENTATIVE
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA
51 CHAMBERS ST. NEW YORK, U.S.A.

PARIS BRUSSELS TURIN BARCELONA RIO DE JANEIRO

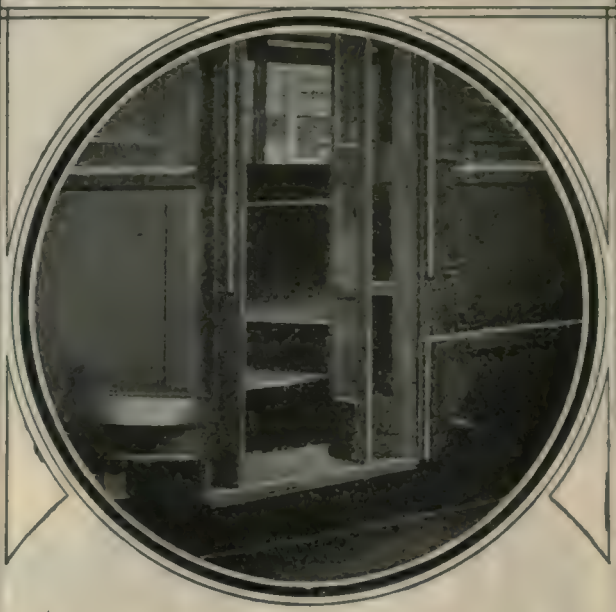
Alabama

411 Elec Cars in state
of which
363 are operated by Co's.
which regularly use
"Tool Steel" gear. pinions

$\frac{363}{411} = 88\ o/o$

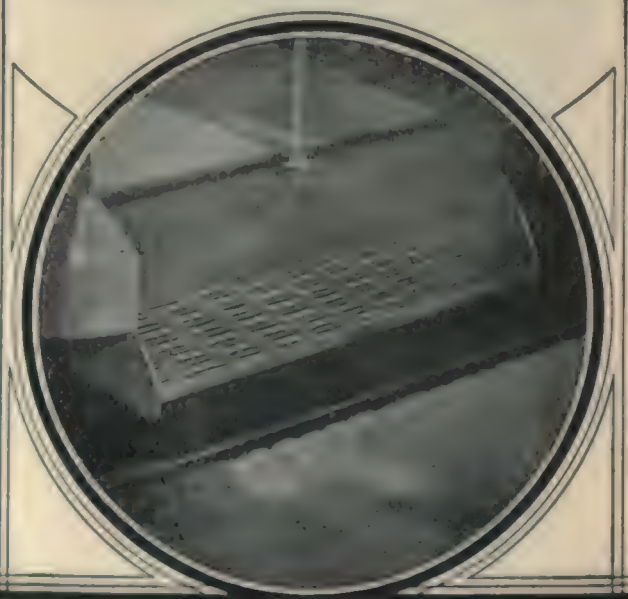
Watch for your state!

IRVING SAFSTEP
TRADE MARK
(PATENTED)
ABSOLUTELY NON-SLIPPING ALWAYS



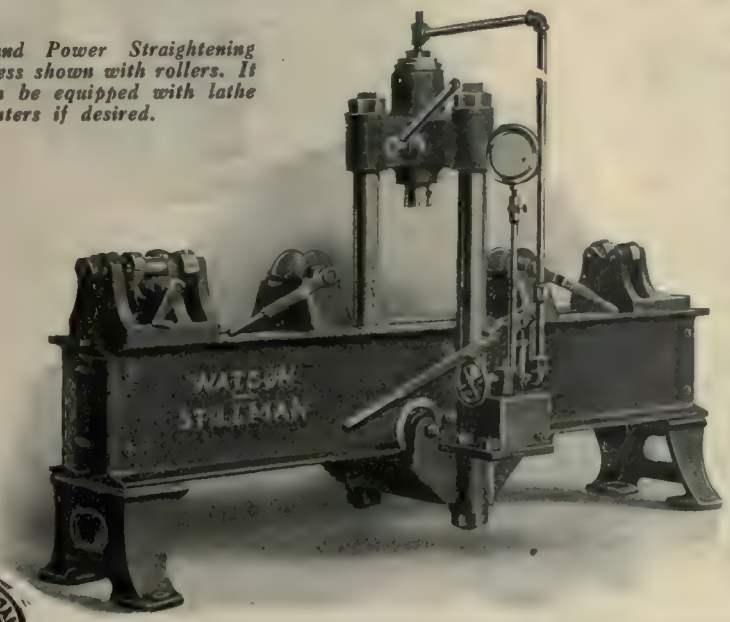
Safety, as assured by its absolutely non-slipping surface, is only one good feature of the **Irving "Safstep."** It will not accumulate dirt, and fill up. **It is a clean step**—which contributes to car cleanliness and good service. It is light, firm, never gets loose and rattly. And it is adapted to any style or type of car. Here is a genuine service improvement awaiting your adoption. Send for Catalog 2A28.

IRVING IRON WORKS CO.
LONG ISLAND CITY, N.Y., U.S.A.



This Press Will Straighten Your Car Axles Properly and Economically

We have furnished many railroad shops with hydraulic presses of this type for straightening axles, shafting and bars, **and for doing hundreds of odd bending jobs.**



Hand Power Straightening Press shown with rollers. It can be equipped with lathe centers if desired.

The ram has a vertical movement of 4 in. The idle portion of the stroke to and from the work is accomplished by a rack and pinion independent of the pump. The bending blocks and roller stands are adjustable to any position on the bed. The traveling frame permits a bending operation at any point between the roller frames.

We build many sizes of hydraulic benders, all as carefully designed as this machine to give the user the best service.

Write for Bulletin giving details of our big line of railway hydraulic machines including Jacks, Forcing Presses, Pit Jacks, Wheel Presses, Shears, Bending Presses, etc., etc.

The Watson-Stillman Co.

Engineers and Builders of Hydraulic Machinery

46 Church Street, New York

CHICAGO—McCormick Building

MAKE YOUR PARK PAY

Your biggest Park expense can be greatly reduced

A WELTE ORCHESTRION

To Supply the Music Insures Your Success

Our automatic brass bands provide just as good music as any full band and our dance hall instruments offer the services of a complete orchestra.

They will save their cost in one season.

Morning and afternoon attractions now possible—without extra cost.

Dealing with the Welte firm you eliminate experiments.

Write to us for particulars and booklets



M. WELTE & SONS, INC.

665, 667 and 669 Fifth Avenue

Orchestrion Dept. Bet. 52nd and 53rd Streets

New York

We Have What You Need!

Let Us Show You—



We make trolley wheels that have to give good service. Our guarantee stands back of every wheel that goes out of our factory.

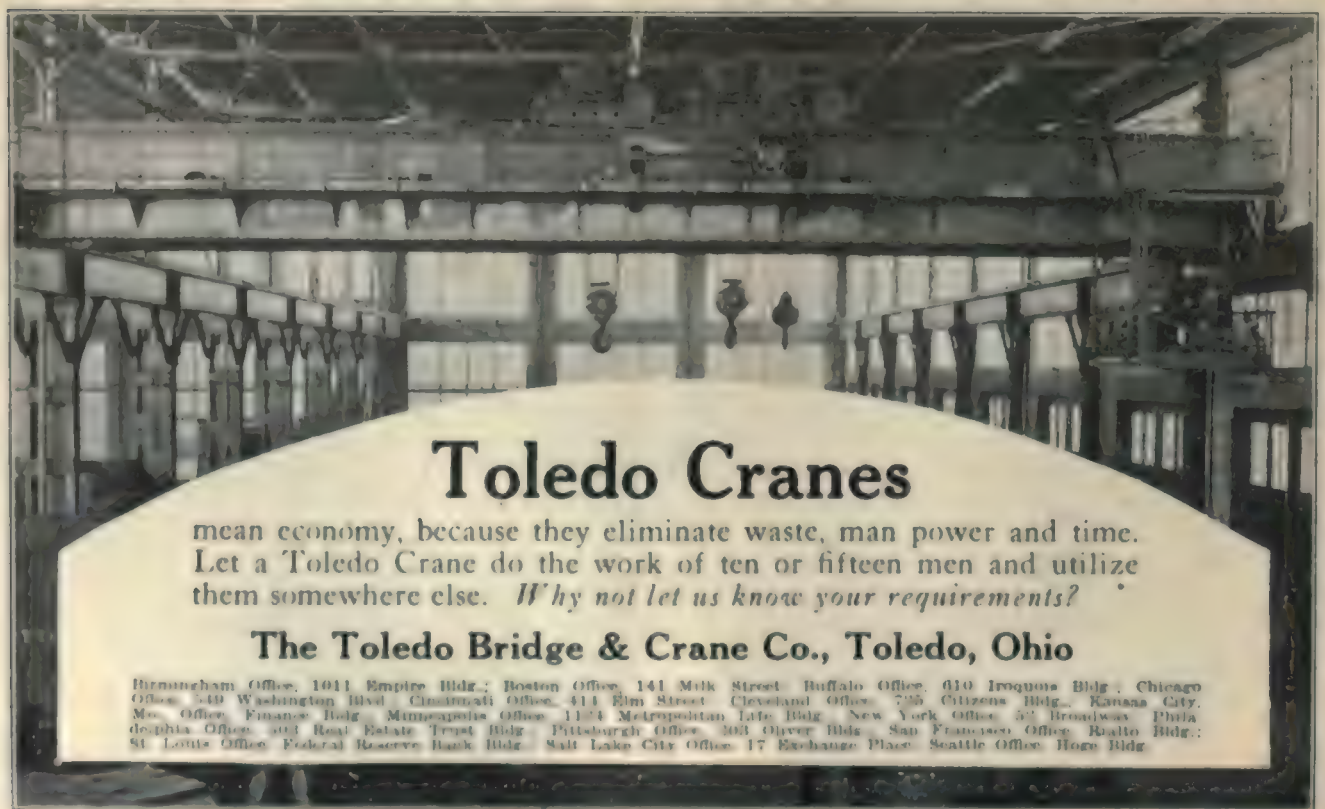
Let us know the size wheel you want, on what size spindle it will run, and the length of hub required. With this information we will send you all the wheels you want. If these do not live up to everything we guarantee, they will cost you nothing no matter how badly they are worn.

This shows how confident we are about our wheels and it will pay you to investigate. You will find us nice people to do business with.

Write for particulars

Hensley Trolley & Mfg. Co., Detroit, Mich.

Toledo Cranes in Your Shops



Toledo Cranes

mean economy, because they eliminate waste, man power and time. Let a Toledo Crane do the work of ten or fifteen men and utilize them somewhere else. *Why not let us know your requirements?*

The Toledo Bridge & Crane Co., Toledo, Ohio

Birmingham Office, 1011 Empire Bldg.; Boston Office, 141 Milk Street; Buffalo Office, 610 Iroquois Bldg.; Chicago Office, 549 Washington Blvd.; Cincinnati Office, 414 Elm Street; Cleveland Office, 736 Citizens Bldg.; Kansas City, Mo., Office, Finance Bldg.; Minneapolis Office, 1174 Metropolitan Life Bldg.; New York Office, 52 Broadway; Philadelphia Office, 503 Real Estate Trust Bldg.; Pittsburgh Office, 303 Oliver Bldg.; San Francisco Office, Rialto Bldg.; St. Louis Office, Federal Reserve Bank Bldg.; Salt Lake City Office, 17 Exchange Place; Seattle Office, Hoge Bldg.



R. D. NUTTALL CO.
Pittsburgh, Pa.

MEMBER OF AGMA

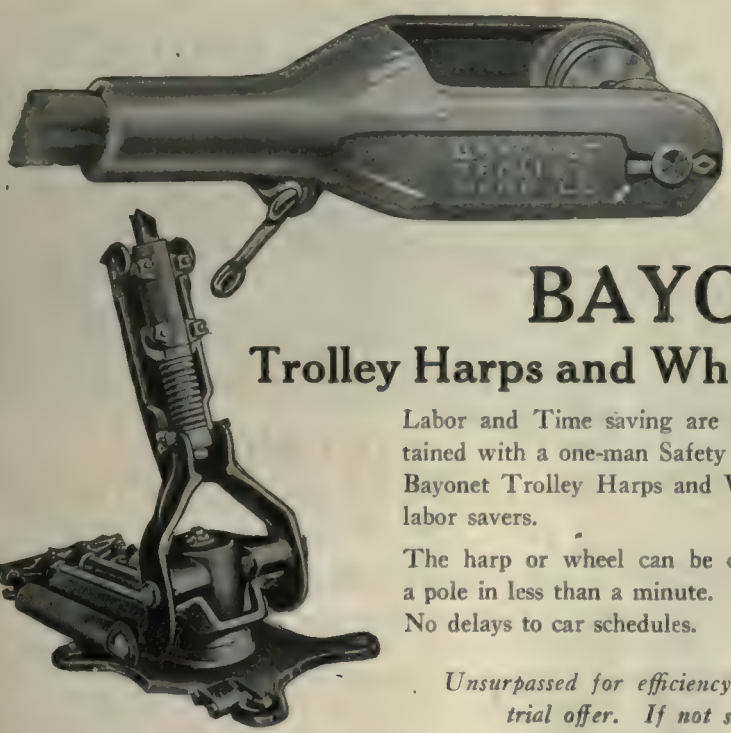
Trolley Bases *for* City Service

The Nuttall 15-C trolley base offers excellent opportunities for the city service operators —particularly those who operate one-man cars—to gain increased economy from their railway systems.

Nuttall Helical Gears

A PROVEN SUCCESS





BAYONET

Trolley Harps and Wheels for Safety Cars

Labor and Time saving are two of the advantages obtained with a one-man Safety Car.
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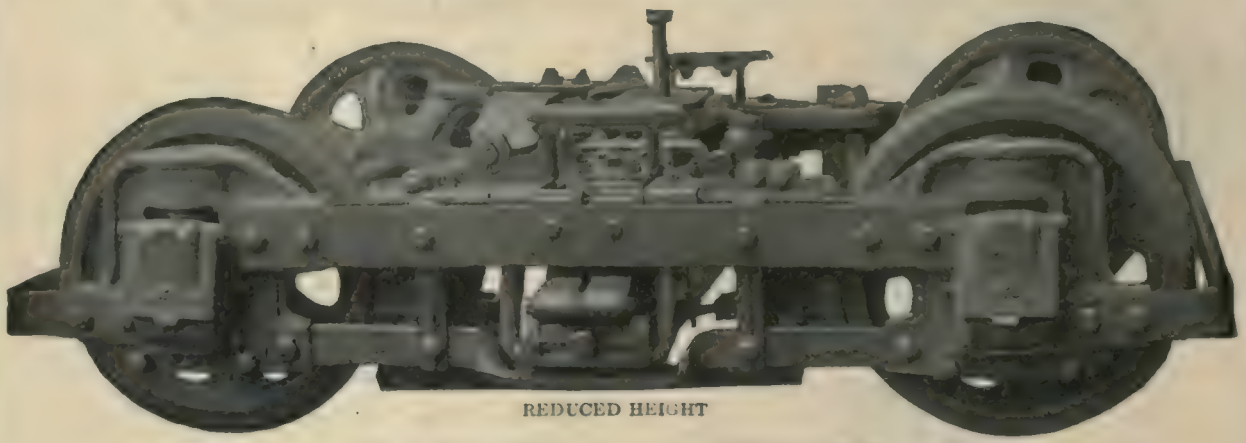
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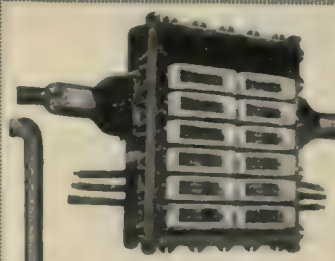
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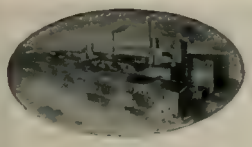


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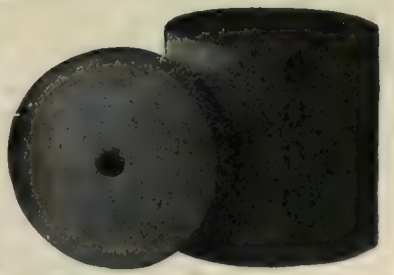
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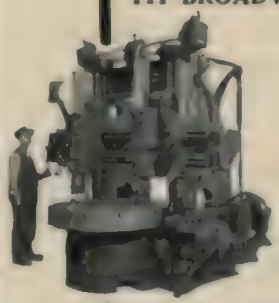
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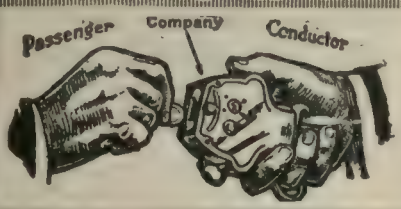
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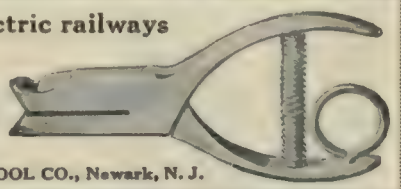


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FIRST-CLASS draftsmen wanted, and estimators familiar with steam and electric railway passenger equipment, by large manufacturing concern in the East. P-622, Elec. Ry. Journal.

GENERAL superintendent wanted, experienced in construction and operation of street railway properties as well as lighting and power. Must have good broad experience covering these lines and possess magagerial and executive ability for operating property of about 100 miles street railway and 10,000 light and power consumers. Good future for right person possessing the above qualities. In reply give age, experience, salary desired, when could report for work as well as for interview. P-621, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

MAN experienced in direct current wanted, trolley and overhead maintenance and construction work. A knowledge of A. C. maintenance and construction desirable but not essential. Man with broad experience and initiative capable of developing into general foreman wanted. In reply give full particulars of experience, salary desired, when could report for work. P-619, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

AN experienced car barn foreman wanted for suburban carhouse in a New England town, who is familiar with Westinghouse H-L equipment and General Electric equipment. P-618, Elec. Ry. Journal.

POSITIONS WANTED

AUDITOR, broad experience in utility accounting and finance, competent executive. A1 credentials. PW-625, Elec. Ry. Journal.

ALLROUND shop man wants position that will be permanent. Have had experience as shop foreman. Address PW-617, Elec. Ry. Journal, Old Colony Bldg., Chicago.

POSITIONS WANTED

EXECUTIVE position by expert operating or transportation man; 5 years' experience in transportation and mechanical departments; also 3 years steam railroad work. Age 35. Will consider any location with future. References A-1. Address 104 N. Third St., Columbus, Ohio, Henry Whisner.

FOREMAN in an inspection barn overhauling shop. Age thirty-eight, sixteen years' experience. References from present employer. Position in South or West preferred. PW-624, Elec. Ry. Journal.

GENERAL manager, now employed, desires to make change. Twenty years' experience in construction and operation. Good education. Highest references. PW-607, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

HIGH grade master mechanic, thirty-five years of age, having fifteen years' experience on all types of city and interurban equipment, desires to make change about June first. Will furnish highest class references, and reasons for leaving present position. Good executive with proven ability to organize and build up an efficient maintenance force. Address PW-615, Elec Ry. Journal.

MAN, 14 years' experience with large street, railway, light, power and gas properties as accountant, assistant to general manager, secretary, treasurer and auditor solicits change. Age 40; large of statue, physically sound with good personality. A-1 references. Address PW-601, Elec. Ry. Journal.

MASTER mechanic, experienced on city, interurban and M. C. B. equipments, modern shop methods and inspection barn systems, one that can form an efficient organization and get results, married, age 38, has good reasons for wanting to make change, correspondence confidential. PW-603, Elec. Ry. Journal, Old Colony Bldg., Chicago.

MASTER mechanic wishes to make a change; have had 16 years' experience on maintenance and construction in all its branches. At present employed as master mechanic by a road operating from 60 to 70 cars. Can furnish A1 reference from last and present employers, PW-614, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

MASTER mechanic having had twenty years' experience in carbons, substations, steam and gas engines, power house, also construction work, wants position. Can give A1 reference from company at present employed with. Southern Co. preferred. PW-613, Elec. Ry. Journal.

A GREAT OPPORTUNITY FOR A PRACTICAL STREET RAILWAY MAN

FOR SALE

The equity in the rights, property and franchises of

THE GROTON AND STONINGTON STREET RAILWAY COMPANY

represented by all of the shares of the capital stock of that company free from all claims except a bonded debt of $475,000 at 5 per cent.

This property consists of 23 miles of track in the towns of Groton and Stonington in the State of Connecticut, with all necessary property and equipment—it serves many populous and thriving comunities and does a gross business of, approximately, $8,000 per mile. Full particulars upon application.

By order of the court, I am authorized to receive bids for the above street railway property.

ROBERT W. PERKINS, *Receiver*
362 Main Street, Norwich, Connecticut

POSITIONS WANTED

STOREKEEPER, age thirty, desires change. Seven years' experience in all branches. Ability to assume full charge. Address PW-623, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

EVENING WORK WANTED

OPERATING statistics, new business possibilities and rate data prepared and analyzed. Accounts prepared and audited. EWW-602, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia, Penn.

AGENTS AND SALESMEN

Manufacturers Attention

Sales representative and engineer, 38 years of age, past 10 years with leading railway supply organization, will establish connection as manufacturer's agent or representative, steam and electric railway supplies on commission basis with salary guarantee; $7,500 minimum. Member of Western Railway Club, Western Society of Engineers, American Institute of Electrical Engineers, Illinois Athletic Club. Twenty years extensive acquaintance, Chicago and Middle West, guarantees capable and efficient representation. Previous executive experience Western district manager. AS-608, Elec. Ry. Journal, Old Colony Bldg., Chicago.

FOR SALE

Rotary Converters

2 150 KW. Gen. Elec., type TC4A, rotary converters, 3-phase, 25 cycle, 273 v. a. c. to 600 v. 250 amp. d. c.; each with 3-60 KW. type H 25 cycle 6600-375 v. oil-cooled indoor type transformers; also both a. c. and d. c. control panels with instruments, speed 750; all in fine condition. Immediate shipment. Gregory Electric Co., 16th & Lincoln St., Chicago.

WANTED

Semi-Interurban Type Cars

about 42 ft. over all, in first-class condition with trucks, 33-in. wheels, without motors, but with controllers and cables.

WARREN STREET RAILWAY CO.
Warren, Pa.

FOR SALE

FORT WAYNE ARC LAMPS

We have 30 No. 83242 second-hand Arc Lamps in good serviceable condition, 5 amperes, 110 volts or can be used in series on 550 volts.

The Duluth Street Railway Co.
2631 W. Superior St., Duluth, Minn.

WANTED

Used Wheel Press

200-ton capacity

WARREN ST. RY. CO.
WARREN, PA.

CARS FOR SALE

2—McKean Gaso Electric Cars.
12—Differential 20-yd. Cars.
6—Gasoline Passenger Cars
50—Freight Cars.
12—Electric Sets.
Get our List and Prices.
J. F. DONAHOO CO., Birmingham, Ala.



Armature Coil Taping Machine

Saves Time, Labor and Money

A boy can tape 40 coils for Westinghouse 12A Armature in an hour. Further particulars gladly furnished.

Geo. M. Griswold Machine Co.
Newhaven, Conn.

WORRYLESS ELECTRICAL REPAIRS

On all kinds and sizes A.C. or D.C. motors and generators, starters, welders, controllers, or anything electrical. Quick shipment from stock material of coils, commutators—shafts—bearings, etc. Remember our initials stand for our product.

CAREFUL CLEVELAND ACCURATE ARMATURE WORRYLESS WORKS, Inc.

EST. 1895 4732-4-6 ST. CLAIR AVE., CLEVELAND INC. 1918

Electric Railway for Sale!

We have purchased the entire equipment of the Cincinnati & Columbus Traction Co., which was operated from Norwood to Hillsboro, O., a distance of approximately 53 miles, and offer for sale the following:

RAILS—

4000 tons No. 1, 70-lb. relaying steel rails.

WIRE—

500,000 lb. or more of copper trolley, feeder, high tension, etc.

POWER EQUIPMENT—

6—Babcock & Wilcox Boilers, 165-lb. pressure, equipped with American Stokers, forced and induced draft, and economizers.
2—Corliss Engines.
Generators.
Switchboards and Transformers.
2—Rotary Converters.

ROLLING STOCK (Standard Gauge)—

Suitable for Industrials only.
5—Box Cars.
3—Flat Cars.
1—Derrick Car.
5—Gondolas.
3—Gondola Cars, Center Dump.

A number of all steel Bridges for quick acceptance at $1.00 per 100 lbs. as is

Write or wire us, stating just what you are interested in, and we will be pleased to submit quotations and further particulars.

HYMAN-MICHAELS COMPANY

(Refer to Department J)

People's Gas Building, Chicago, Ill.

Branches: New York City—Pittsburgh—St. Louis

RAILS IN STOCK

IMMEDIATE SHIPMENT

GUARANTEED

10,000 Tons New 12-lb. to 100-lb., and fastenings.
40,000 Tons New Open-hearth, first quality, 80 lb.
5,000 Tons Relayers, 25 to 100 lb., and fastenings.
Car and less carload inquiries and orders solicited.
Rails cut to lengths for all purposes.

TRACK ACCESSORIES
BOLTS, NUTS AND SPIKES

We Manufacture

FROGS, SWITCHES, CROSSINGS, PORTABLE TRACK, DUMP CARS, PLATFORM CARS, ETC.

L. B. FOSTER COMPANY

Park Building, Pittsburgh, Pa.
Tribune Building, 154 Nassau St., New York, N. Y.

Machinery in Stock for *Immediate Shipment*

ROTARY CONVERTERS

2—300 kw., Westg., 3-phase, 60-cycle, 370-v., A.C., 575-v., D.C., 600 r.p.m.
2—200 kw., G.E., 3-phase, 25-cycle, 85-v., A.C., 125-v., D.C., 8 pole, 375 r.p.m.
1—150 kw., Westg., 2- or 3-phase, 60-cycle, 185-v., A.C., 250-v., D.C., 720 r.p.m.

FREQUENCY CHANGER SET

1—600 kva., Allis-Chalmers Frequency Changer Set, 300 r.p.m., 3-phase, 60-cycle, 2300-v. one end, 3-phase, 6600-v., 25-cycle on other end.

ARCHER & BALDWIN, INC.
114-118 Liberty Street, New York City
Telephone 4337-4338 Rector

INTERURBAN CAR

IMMEDIATE DELIVERY

CAR BODY—Niles Car Company

Passenger compartment combined baggage and smoker	
Length over bumpers	52 ft. 6 in.
Extreme width	9 ft. 0 in.
Height—rail to run. bd.	13 ft. 2 in.
Seating capacity	60

TRUCKS—American Locomotive

Wheel base			6 ft. 10 in.
Truck centers			30 ft. 8 in.
Diam. of wheels	36 in.	Axles	6 in.

EQUIPMENT

4—Westinghouse 112B Motors
2—K 34B Controllers
CP 27 Air Compressors
Westinghouse Air Brake
Peter Smith Hot Water Heater.

L. G. VAN NESS,
1431 Union Trust Bldg., Cincinnati, Ohio

Caution—RAIL USERS

If you contemplate needing more track during 1920, BUY NOW. There will be a SCARCITY. We own and offer the following NEW RAILS for prompt shipment:

New 12-lb. Rails, splices, bolts and nuts.
New 30-lb. Rails, angle bars, bolts and nuts.
70-lb. ASCE Relayers.
New 80-lb. Rails, angle bars, bolts, nuts and spikes.
New 90-lb. Rails, angle bars, bolts, nuts and spikes.

They will be gone soon. Write or wire for our quotations.

HYMAN-MICHAELS COMPANY
531 Peoples Gas Bldg., Chicago

BRANCH OFFICES: First National Bank Bldg., Pittsburgh, Pa.; Railway Exchange Bldg., St. Louis, Mo.; East Chicago, Ind.
YARDS AND WAREHOUSES: East Chicago, Ind. and St. Louis, Mo.

STREET CARS

3—32-ft., 4-ft. 8½-in. ga. closed motor cars; seating capacity 32. Symington-Baldwin trucks. First Class. Will convert to one man operation if desired.
4—22-ft., 4-ft. 8½-in. ga., open trailers; seating capacity 35. Taylor McGuire trucks. Good.

ZELNICKER IN ST. LOUIS

For a list of hundreds of other unusual bargains in Rails, Railway and Industrial Machinery and Equipment write for Our Latest General Bulletin.

FOR SALE

4—Center Entrance, All-Steel Cars, Plain Arch Roof, 35 ft. over bumpers, Taylor Double Trucks.

2—G.E. 247-A Box Frame Motors.
2—K-10-P Controllers.

Complete. Splendid Condition. Full details upon request.

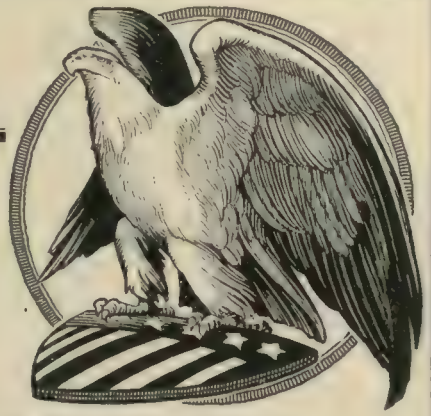
ELECTRIC EQUIPMENT COMPANY
Commonwealth Bldg., Philadelphia, Pa.

"Opportunity" Advertising:

Think *"SEARCHLIGHT"* First!

0098

WAR DEPT. SALE—SURPLUS PROPERTY



Fill Depleted Stock Bins!

Bid on these

Square Head Machine Bolts

Old Hickory District of the Ordnance Department is offering for sale a large quantity of **Square Head Machine Bolts,** some with square nuts and some with hexagon nuts. These bolts are new and are stored in warehouses at Old Hickory Powder Plant.

You can buy these bolts at reasonable prices but you must act quickly to obtain the sizes you need.

A CHANCE TO FILL DEPLETED STOCK BINS

MACHINE BOLTS

Square Head—Square Nut

Quantity	Size
2667	¼ in. x 5 in.
11542	¼ in. x 2½ in.
2933	¼ in. x 1 in.
12130	¼ in. x 2 in.
7762	¼ in. x 2½ in.
3252	¼ in. x 2½ in.
5252	¼ in. x 3 in.
9896	¼ in. x 3½ in.
11732	¼ in. x 4 in.
30880	¼ in. x 4½ in.
6469	¼ in. x 5 in.
4042	¼ in. x 6 in.
11700	¼ in. x 1½ in.
3604	¼ in. x 2 in.
6361	¼ in. x 2½ in.
17900	¼ in. x 3 in.
5500	¼ in. x 3½ in.
2520	¼ in. x 5 in.
4726	¼ in. x 6 in.
4500	¼ in. x 8 in.
2000	¼ in. x 10 in.
2600	¼ in. x 12 in.
2857	¼ in. x 16 in.
2400	⅜ in. x 1 in.
2240	⅜ in. x 1½ in.
2981	⅜ in. x 1¾ in.
3665	⅜ in. x 1½ in.
18623	⅜ in. x 2 in.
26611	⅜ in. x 2½ in.
13020	⅜ in. x 2¾ in.
22835	⅜ in. x 3 in.
5146	⅜ in. x 3½ in.
5542	⅜ in. x 3¾ in.
5230	⅜ in. x 4 in.
5381	⅜ in. x 5 in.
3568	⅜ in. x 6 in.
5100	⅜ in. x 8 in.
3300	⅜ in. x 10 in.
2641	⅜ in. x 12 in.
1200	⅜ in. x 14 in.
1600	⅜ in. x 16 in.
1710	⅜ in. x 18 in.
1000	⅜ in. x 21 in.
1487	⅜ in. x 22 in.
3700	⅜ in. x 1½ in.
7641	⅜ in. x 2 in.
5056	⅜ in. x 2½ in.
112780	⅜ in. x 3 in.
3420	⅜ in. x 3 in.
7260	⅜ in. x 3½ in.
8107	⅜ in. x 3½ in.
9580	⅜ in. x 4 in.
14784	⅜ in. x 4½ in.
6092	⅜ in. x 5 in.
3677	⅜ in. x 5½ in.
7288	⅜ in. x 6 in.
3291	⅜ in. x 7 in.
5520	⅜ in. x 8 in.
7534	⅜ in. x 9 in.
6413	⅜ in. x 10 in.
13580	⅜ in. x 12 in.
4266	⅜ in. x 14 in.
1103	⅜ in. x 15 in.
5504	⅜ in. x 16 in.
1254	⅜ in. x 17 in.
7675	⅜ in. x 18 in.
1686	⅜ in. x 19 in.
5227	⅜ in. x 20 in.
2751	⅜ in. x 21 in.
3453	⅜ in. x 22 in.
3557	⅜ in. x 24 in.
1193	⅜ in. x 25 in.
1422	⅜ in. x 37 in.
2233	⅜ in. x 2½ in.
1445	⅜ in. x 3 in.
4301	⅜ in. x 3½ in.
2715	⅜ in. x 4 in.
4947	⅜ in. x 4½ in.
3594	⅜ in. x 8 in.
2322	⅜ in. x 9 in.
2623	⅜ in. x 10 in.
2048	⅜ in. x 12 in.
2563	⅜ in. x 14 in.
2730	⅜ in. x 16 in.
3402	⅜ in. x 18 in.
2022	⅜ in. x 20 in.
2146	⅜ in. x 22 in.
1225	⅜ in. x 24 in.
1945	1 in. x 4 in.
1809	1 in. x 5 in.
2658	1 in. x 5½ in.
2516	1 in. x 6 in.
1029	1 in. x 9 in.
1470	1 in. x 10 in.
1440	1¼ in. x 4½ in.
2650	1¼ in. x 5½ in.
3057	1¼ in. x 6½ in.
1086	1¼ in. x 7 in.

MACHINE BOLTS

Square Head
Hexagon Nut

Quantity	Size
3230	¼ in. x 6 in.
2800	⅜ in. x 1 in.
4479	⅜ in. x 1¼ in.
2636	⅜ in. x 2 in.
15066	⅜ in. x 2½ in.
3656	⅜ in. x 3 in.
2402	⅜ in. x 4 in.
2785	⅜ in. x 4½ in.
2850	⅜ in. x 1½ in.
12881	⅜ in. x 2½ in.
8006	⅜ in. x 3 in.
20512	⅜ in. x 2½ in.
8225	⅜ in. x 2½ in.
13920	⅜ in. x 3 in.
2630	⅜ in. x 3½ in.
2666	⅜ in. x 1½ in.
2202	⅜ in. x 2 in.
2053	⅜ in. x 2½ in.
81567	⅜ in. x 3 in.
14285	⅜ in. x 3½ in.
6956	⅜ in. x 3½ in.
7621	⅜ in. x 4 in.
1575	⅜ in. x 5 in.
2901	⅜ in. x 9 in.
4137	⅜ in. x 3½ in.
3652	⅝ in. x 4½ in.
4401	1 in. x 4 in.
2100	1 in. x 4½ in.
4718	1 in. x 5½ in.
2112	1 in. x 6½ in.
3898	1¼ in. x 4½ in.
2699	1¼ in. x 6 in.
3736	1¼ in. x 6½ in.
2621	1¼ in. x 6 in.

This is only a partial list of the Machine Bolts offered for sale. There are also being offered for sale Carriage Bolts and various kinds and sizes of Rivets. Full details in Proposal No. 137

Important Notice

Other materials and equipment available for sale in this District are offered in the weekly Bulletin. The principal item listed are Acids, Chemicals, Lead, Zinc, Tin, Solder, Iron Wire and Sheets, Corliss Engines, Paper Making Machinery, Machine Bolts, C. I. Soil Pipe and Fittings, Fabricated Steel Shafting, Iron and Steel Bars, Brick, Garbage Cans, Brooms, etc.

Send in your name to be placed on our mailing list. Address:

Commanding Officer,
Old Hickory Powder Plant,
Jacksonville, Tenn.

Read the Conditions of Sale—Telegraph or write for Proposal 137

Old Hickory District of the Ordnance Department, United States Army, offers for sale the material listed in this advertisement.

Sealed Bids on Blank No. 137, in duplicate, will be accepted at the office of the Commanding Officer, Old Hickory Powder Plant, Jacksonville, Tennessee, until 11.00 A. M. CENTRAL TIME APRIL 19th, 1920, at which time and place they will be opened in the presence of attending bidders or their authorized representatives.

Bids may be made for all material listed or any part thereof. A certified check for 10% of the amount of bid must accompany all bids. The Government reserves the right to waive all technicalities and to reject or accept any or all bids or any part thereof. Shipments will be made as soon as possible after date of award. Goods are sold "as is" at point of storage. Failure to inspect will not warrant rejections. Permits to inspect may be obtained on application to Commanding Officer, Old Hickory Powder Plant, Jacksonville, Tennessee.

BIDS CLOSE 11.00 A. M. CENTRAL TIME APRIL 19th, 1920.

Telegraph or write for blank proposal No. 137.

NOTE: Old Hickory Powder Plant, Jacksonville, Tennessee, may be reached by train, interurban trolley or automobile from Nashville, Tenn.

OLD HICKORY DISTRICT
U.S. ARMY ORD. DEPT.
SALVAGE BOARD

Ordnance Department U. S. Army

OLD HICKORY POWDER PLANT

JACKSONVILLE TENNESSEE

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

Acetylene Service & Apparatus
Oxweld Acetylene Co.

Advertising, Street Car
Collier, Inc., Barron G.

Air Receivers
Ingersoll-Rand Co.

Air Aftercoolers
Ingersoll-Rand Co.

Ammeters
Weston Elec'l Instrument Co.

Anchors, Guy
Chance Co., The
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse Elec. & M. Co.

Angle Bars
Lackawanna Steel Co.

Ash Storage Tanks, Cast Iron
Green Engineering Company

Automobile and Buses
Brill Co., The J. G.
White Co., The

Axle Straighteners
Columbia M. W. & M. I. Co.

Axles, Car Wheel
Bemis Car Truck Co.
Brill Co., The J. G.
Standard Steel Works Co.
St. Louis Car Co.
Taylor Electric Truck Co.
Westinghouse Elec. & M. Co.

Babbitt Metal
Ajax Metal Co.
More-Jones B. & M. Co.

Babbitting Devices
Columbia M. W. & M. I. Co.

Badges and Buttons
Electric Service Supplies Co.
International Register Co., The

Bankers & Brokers
Coal & Iron National Bank

Batteries, Storage
Electric Storage Battery Co.

Bearings and Bearing Metals
Ajax Metal Co.
Brady Brass Company
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
More-Jones Brass & Metal Co.
St. Louis Car Co.
Taylor Electric Truck Co.
Westinghouse Elec. & M. Co.

Bearings, Center and Roller Side
Stucki Co., A.

Bells and Gongs
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
St. Louis Car Co.

Benders, Rail
Niles-Bement-Pond Co.
Watson-Stillman Co.
Zelnicker, Walter A., Supply Co. Inc.

Boilers
Babcock & Wilcox Co.

Boiler Tubes
National Tube Co.

Bond Testers
American Steel & Wire Co.

Bonding Apparatus
American Steel & Wire Co.
Electric Railway Improvement Co.
Electric Service Supplies Co.
Ohio Brass Co.
Oxweld Acetylene Co.

Bonds, Rail
American Steel & Wire Co.
Electric Railway Improvement Co.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & M. Co.

Book Publishers
McGraw-Hill Book Co., Inc.

Boring Tools, Car Wheel
Niles-Bement-Pond Co.

Brackets and Cross Arms, (See also Poles, Ties, Posts, Etc.)
American Bridge Co.
Bates Expanded Steel Truss Co.
Creaghead Eng. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Hubbard & Co.
Lindsley Bros. Co.
Ohio Brass Co.

Brake Adjusters
National Railway Appliance Co.
Westinghouse Traction Brake Co.

Brake Shoes
Amer. Brake Shoe & Fdry. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Taylor Electric Truck Co.
Wheel Truing Brake Shoe Co.

Brakes, Brake Systems and Brake Parts
Ackley Brake & Supply Corp.
Allis-Chalmers Mfg. Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
General Electric Co.
National Brake Co.
Safety Car Devices Co.
St. Louis Car Co.
Taylor Electric Truck Co.
Westinghouse Traction Brake Co.

Bricks, Fire
Green Engineering Co.

Bridges & Buildings
American Bridge Co.

Brooms, Track, Steel or Rattan
Zelnicker, Walter A., Supply Co., Inc.

Brushes, Carbon
General Electric Co.
Jeandron, W. J.
Morgan Crucible Co.
United States Graphite Co.
Westinghouse Elec. & M. Co.

Brushes, Graphite
United States Graphite Co.

Brush Holders
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.

Bunkers, Coal
American Bridge Co.

Bushings
Ives Co., The H. B.

Bushings, Case Hardened & Manganese
Bemis Car Truck Co.

Bushings, Graphite & Wooden
Bound Brook Oilless Bearing Co.

Cables. (See Wires and Cables)

Calculating Machines
Monroe Calculating Machine Co.

Carbon Brushes. (See Brushes, Carbon)

Car Equipment. (For Fenders, Heaters, Registers, Wheels, etc. See those headings)

Car Trimmings. (For Curtains, Registers, Doors, Seats, etc. See those headings)

Car Panel Safety Switches
Westinghouse Elec. & Mfg. Co.

Cars, Passenger, Freight, Express, etc.
American Car Co.
Brill Co., The J. G.
Kuhlman Car Co., G. C.
McGuire-Cummings Mfg. Co.
National Railway Appliance Co.
Thomas, Perley A.
Wason Mfg. Co.

Cars, Second Hand
Electric Equipment Co.

Car, Self-Propelled
Electric Storage Battery Co.
General Electric Co.

Castings, Brass, Composition or Copper
Ajax Metal Co.
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.
More-Jones Brass & Metal Co.

Castings, Gray Iron and Steel
American Bridge Co.
American Steel Foundries
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Standard Steel Works Co.
St. Louis Car Co.

Castings, Malleable and Brass
Amer. Brake Shoe & Fdry. Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.

Catchers and Retrievers. Trolley
Electric Service Supplies Co.
Ohio Brass Co.
Wood Co., Chas. N.

Circuit Breakers
Cutler Electrical & Mfg. Co. The
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps and Connectors for Wires and Cables
Anderson Mfg. Co., A. & J. M.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hubbard & Co.
Klein & Sons, Matthias
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Cleaners and Scrapers Track—(See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.
Ohio Brass Co.

Clusters and Sockets
General Electric Co.

Coal and Ash Handling—(See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Coils, Armature and Field
Cleveland Armature Works
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Rome Wire Co.
Westinghouse Elec. & M. Co.

Coils, Choke and Kicking
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Coin-Counting Machines
Electric Service Supplies Co.
International Register Co., The
Johnson Fare Box Co.

Comelong
Bush Electric Co.

Commutator Slotters
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Commutator Truing Devices
General Electric Co.

Commutators or Parts
Cameron Electrical Mfg. Co.
Cleveland Armature Works
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Compressors, Air
Allis-Chalmers Mfg. Co.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Trac. B. Co.

Compressors, Gas
Ingersoll-Rand Co.

Condensers
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Conduit Fittings
Chicago Fuse Mfg. Co.

Conduits, Underground
Standard Underground Cable Co.

Connectors, Solderless
Frankel Connector Co.
Westinghouse Elec. & Mfg. Co.

Controller Fingers
Eureka Co.
Russell Mfg. Co.

Controllers or Parts
Allis-Chalmers Mfg. Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Russell Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Controller Regulators
Electric Service Supplies Co.

Controlling Systems
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Converters, Rotary
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Conveyors, Belt
Portable Machinery Co.

Conveyors, Coal & Ash
Green Eng. Co.
Portable Machinery Co.

Conveyors, Portable
Portable Machinery Co.

Conveying and Hoisting Machinery
American Bridge Co.
Columbia M. W. & M. I. Co.
Green Engrg. Co.

Copper Wire
Anaconda Copper Mining Co.

Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Roeblings Sons Co., John A.
Samson Cordage Works

Cord Connectors and Couplers
Electric Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.

Couplers, Car
Brill Co., The J. G.
Ohio Brass Co.
Van Dorn Coupler Co.
Westinghouse Trac. B. Co.

Cranes
Allis-Chalmers Mfg. Co.
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The

Creosoting. (See Wood Preservatives)

Cross Arms. (See Brackets)

Crossing Foundations
International Steel Tie Co.

Crossing Signals. (See Signals, Crossing)

Crushers, Rock
Allis-Chalmers Mfg. Co.

Crossings, Track. (See Track, Special Work)

Curtains and Curtain Fixtures
Brill Co., The J. G.
Electric Service Supplies Co.

Cutouts
Chicago Fuse Mfg. Co.

Cutting Apparatus, Oxy-Acetylene
Oxweld Acetylene Co.

Dealers' Machinery
Archer & Baldwin
Cleveland Armature Wks.
Electric Equipment Co.
Foster Co., L. B.
Griswold Machine Co., Geo. M.
Hyman Michaels Co.
MacGovern & Co., Inc.
Zelnicker Supply Co., Inc., Walter A.

Derailing Devices. (See also Track Work)
Cleveland Frog & Crossing Co.

Destination Signs
Columbia M. W. & M. I. Co.
Creaghead Eng. Co.
Electric Service Supplies Co.

Detective Service
Wish Service, P. Edward

Dogs, Lathe
Williams & Co., J. H.

Door Operating Devices
Consolidated Car Heating Co.
National Pneumatic Co., Inc.
Safety Car Devices Co.

Doors and Door Fixtures
Brill Co., The J. G.
General Electric Co.
Hale & Kilburn Corp.

Doors, Folding Vestibule
National Pneumatic Co., Inc.

Draft Rigging. (See Couplers)

Drills, Rock
Ingersoll-Rand Co.

Drills, Track
American Steel & Wire Co.
Electric Service Supplies Co.
Niles-Bement-Pond Co.
Ohio Brass Co.

Drinking Cups, Sanitary Paper
Individual Drinking Cup Co., Inc.

Dryers, Sand
Electric Service Supplies Co.
Zelnicker Supply Co., Walter A., Inc.

Electrical Wires and Cables
Roebling's Sons Co., J. A.

Engineers, Consulting, Contracting and Operating
Archbald Brady Co.
Arnold Co., The
Clark Management Corp., E. W.
Dean & Co., A. L.
Feustel, Robert M.
Ford, Bacon & Davis
Holst, Engelhardt W.
Jacobs & Co., J. L.
Republic Engineers, Inc.
Rucker, Albert S.
Robinson & Co., Dwight P.
Sanderson & Porter
Sargent & Lundy
Scofield Engineering Co.
Stone & Webster
Wells, Gardner F.
White Eng. Corp'n, The J. G.



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Electrical Indicating Instruments

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have always been made of entirely new metal, which accounts for their long life WITHOUT INJURY TO THE WIRE. Do not be misled by statements of large mileage, because a wheel that will run too long will damage the wire. If our catalogue does not show the style you need, write us—the LARGEST EXCLUSIVE TROLLEY WHEEL MAKERS IN THE WORLD.



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The "Hycap-Exide" Battery for STORAGE BATTERY STREET CARS

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Express, Combination and Work Cars, Electric Locomotives

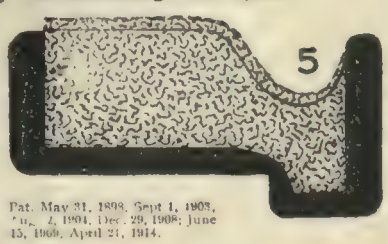
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DETROIT, MICHIGAN

WHAT AND WHERE TO BUY

Engines, Gas and Oil
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Engines, Steam
Allis-Chalmers Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Fare Boxes
Brill Co., The J. G.
Cleveland Fare Box Co.
Johnson Fare Box Co.
National Railway Appliance Co.
Ohmer Fare Register Co.

Fences, Woven Wire and Fence Posts
American Steel & Wire Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Cleveland Fare Box Co.
Consolidated Car Fender Co.
Electric Service Supplies Co.
Star Brass Works.

Fibre and Fibre Tubing
Westinghouse Elec. & Mfg. Co.

Field Coils. (See Coils)

Filters, Water
Scaife & Sons Co., Wm. B.

Fire Extinguishing Apparatus
Castle Inc., James M.

Floodlights
Electric Service Supplies Co.

Flooring Composition
American Mason Safety Thread Co.

Flooring, Grating
Irving Iron Wks.

Forgings
Columbia Machine Wks. & M. Co.
Eureka Co.
Standard Steel Works Co.
Williams & Co., J. H.

Frogs, Track. (See Track Work)

Furnaces. (See Stokers)

Fuses and Fuse Boxes
Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
D. & W. Fuse Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co., J. H.

Fuses, Refillable
Columbia M. W. & M. I. Co.
General Electric Co.

Fuse Removers
Bush Electric Co.

Gages, Oil and Water
Ohio Brass Co.

Gaskets
Power Specialty Co.
Westinghouse Traction Brake Co.

Gas-Electric Cars
General Electric Co.

Gas Producers
Westinghouse Elec. & Mfg. Co.

Gates, Car
Brill Co., The J. G.

Gear Blanks
Standard Steel Works Co.

Gear Cases
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Westinghouse Elec. & Mfg. Co.

Gears and Pinions
Ackley Brake & Supply Corp'n
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
National Railway Appliance Co.
Nuttall Co., R. D.
Tool Steel Gear & Pinion Co.

Generating Sets, Gas-Electric
General Electric Co.

Generators
Allis-Chalmers Mfg. Co.
English Electric Co., Ltd.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Gongs. (See Bells and Gongs)

Graphite
Morgan Crucible Co.

Grates, Chain
Green Eng. Co.

Greases. (See Lubricants)

Grinders and Grinding Supplies
Indianapolis Switch & Frog Co.
Metal & Thermit Corp.
Railway Track-work Co.

Grinding Blocks and Wheels
Railway Track-work Co.

Guards, Cattle
American Bridge Co.

Guards, Trolley
Electric Service Supplies Co.
Ohio Brass Co.

Harps, Trolley
Anderson M. Co., A. & J. M.
Bayonet Trolley Harp Co.
Electric Service Supplies Co.
Hunter Trolley & Mfg. Co.
Ohio Brass Co.
Page & Hill Co.
Nuttall Co., R. D.
Star Brass Works.

Headlights
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
St. Louis Car Co.

Heaters, Car (Electric)
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
National Railway Appliance Co.
Smith Heater Co., Peter

Heaters, Car, Hot Air and Water
Cooper Heater Co.
Smith Heater Co., Peter

Heaters, Car (Stove)
Electric Service Supplies Co.
Smith Heater Co., Peter

Hoists and Lifts
Columbia M. W. & M. I. Co.
Duff Mfg. Co.
Ford-Chain Block Co.
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The
Yale & Towne Mfg. Co.

Hose
Ingersoll-Rand Co.

Hose, Bridges
Ohio Brass Co.

Hydraulic Machinery
Allis-Chalmers Mfg. Co.
Niles-Bement-Pond Co.
Watson-Stillman Co.

Inspection
Electrical Testing Lab's

Instruments, Measuring, Testing and Recording
Economy Electric Devices Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec'l Instrument Co.

Insulating Cloth, Paper and Tape
Anchor Webbing Co.
General Electric Co.
Hope Webbing Co.
Okonite Co., The
Standard Underground Cable Co.
U. S. Rubber Co.
Westinghouse Elec. & Mfg. Co.

Insulating Machinery
American Insulating Machinery Co.

Insulation. (See also Paints)
Anderson M. Co., A. & J. M.
Drew Electric & Mfg. Co.
Electric Ry. Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Mitchell-Rand Mfg. Co.
Okonite Co., The
U. S. Rubber Co.
Westinghouse Elec. & Mfg. Co.

Insulators. (See also Line Material)
Anderson M. Co., A. & J. M.
Creaghead Engineering Co.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
General Electric Co.
Locke Insulator Corp.
Macallen Co., The
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Insulator Pins
Electric Service Supplies Co.
Hubbard & Co.

Inventions Developed & Perfected
Peters & Co., G. D.

Jacks. (See also Cranes, Hoists and Lifts)
Brill Co., The J. G.
Buckeye Jack Mfg. Co.
Columbia M. W. & M. I. Co.
National Ry. Appliance Co.
Templeton, Kenly Co., Ltd.
Watson-Stillman Co.

Joints, Rail
Zelnicker Supply Company, Inc., Walter A.

Journal Boxes
Bemis Car Truck Co.
Brill Co., J. G.

Junction Boxes
Standard Underground Cable Co.

Laboratories
Electric Testing Lab's

Lamp Guards and Fixtures
Anderson M. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Arc and Incandescent. (See also Headlights)
Anderson M. Co., A. & J. M.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Signal and Marker
Ohio Brass Co.

Lathe Attachments
Williams & Co., J. H.

Lathes, Car Wheel
Niles-Bement-Pond Co.

Lightning Protection
Anderson M. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Line Material. (See also Brackets, Insulators, Wires, etc.)
Anderson M. Co., A. & J. M.
Archbold Brady Co.
Chance Co., The
Columbia M. W. & M. I. Co.
Creaghead Eng. Co.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
English Electric Co., Ltd.
Eureka Co.
General Electric Co.
Hubbard & Co.
Locke Insulator Corp.
Macallen Co., The
More-Jones B. & M. Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Loaders, Wagon, Truck or Car
Portable Machinery Co.

Locomotives, Electric
Brill Co., The J. G.
General Electric Co.
McGuire-Cummings Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Lubricating Engineers
Galena-Signal Oil Co.
Texas Co., The
Universal Lubricating Co.

Lumber. (See Poles, Ties, etc.)

Lubricants, Oil and Grease
Borne, Scrymser Co.
Galena Signal Oil Co.
Texas Co., The
Universal Lubricating Co.

Machine Tools
Columbia M. W. & M. I. Co.
Niles-Bement-Pond Co.
Watson-Stillman Co.

Machine Work
Columbia M. W. & M. I. Co.

Meters, Car, Watt-Hour
Economy Electric Devices Co.

Meters. (See Instruments)
Electric Service Supplies Co.

Mica
Macallen Co., The

Mirrors for Motormen
Drew Elec. & Mfg. Co.

Motormen's Seats
Electric Service Supplies Co.
Wood Co., Chas. N.

Motors, Electric
Allis-Chalmers Mfg. Co.
English Electric Co., Ltd.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Motor and Generator Sets
General Electric Co.

Nuts and Bolts
Allis-Chalmers Mfg. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Hubbard & Co.

Ohmmeters
Weston Elec'l Instrument Co.

Oils. (See Lubricants)

Orchestrions
Welte & Sons Inc., M.

Oxy-Acetylene. (See Cutting Apparatus, Oxy-Acetylene)

Packing
Power Specialty Co.
U. S. Rubber Co.
Westinghouse Traction Brake Co.

Paints and Varnishes (Insulating)
Mitchell-Rand Mfg. Co.

Paints and Varnishes, Preservative
Ackley Brake & Supply Corp'n

Paints and Varnishes for Woodwork
National Ry. Appliance Co.

Paving Material
American Brake Shoe & Fdry. Co.

Pickups, Trolley Wire
Electric Service Supplies Co.
Ohio Brass Co.

Pinion Pullers
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
Wood Co., Chas. N.

Pinions. (See Gears)

Pins, Case Hardened, Wood and Iron
Bemis Car Truck Co.
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse Traction Brake Co.

Pipe
National Tube Co.

Pipe Fittings
Power Specialty Co.
Standard Steel Works Co.
Watson-Stillman Co.
Westinghouse Traction Brake Co.

Planers. (See Machine Tools)

Pliers, Insulated
Electric Service Supplies Co.

Pneumatic Tools
Ingersoll-Rand Co.

Pole Reinforcing
Hubbard & Co.

Poles, Metal Street
Bates Expanded Steel Truss Co.
Electric Railway Equipment Co.
Hubbard & Co.

Pole Sleeves
Drew Elec. & Mfg. Co.

Poles, Ties, Posts, Piling and Lumber
Carney & Co., B. J.
Lindsley Bros. Co.
Page & Hill Co.
Southern Cypress Mfrs. Assn.
Western Red Cedar Assn.

Poles and Ties, Treated
Lindsley Bros. Co.
Page & Hill Co.

Poles, Trolley
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
National Tube Co.
Nuttall Co., R. D.

Poles, Tubular Steel
Electric Railway Equipment Co.
National Tube Co.

Potheads
Okonite Co., The

Power Saving Devices
Arthur Power Saving Recorder Co.
Economy Electric Devices Co.
National Railway Appliance Co.

Pressure Regulators
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Pumps
Allis-Chalmers Mfg. Co.
Schutte & Koerting Co.
Watson-Stillman Co.

Punches, Ticket
Bonney-Vehslage Tool Co.
International Register Co., The
Wood Co., Chas. N.

Punching Machinery
Watson-Stillman Co.

Purifiers, Feed Water
Scaife & Sons Co., Wm. B.

Rails
Foster & Co., L. B.
Lackawanna Steel Co.

Rail Grinders. (See Grinders)

Rail Joint Plates
Lackawanna Steel Co.

Railway Safety Switches
Westinghouse Elec. & Mfg. Co.

Rail Welding. (See Brazing and Welding Processes)

Rails, Relaying
Foster & Co., L. B.
Zelnicker, Walter A., Supply Co. Inc.

Rattan
Brill Co., The J. G.
Electric Service Supplies Co.
Hale & Kilburn Corp.
McGuire-Cummings Mfg. Co.

Recorders, Power Saving
Arthur Power-Saving Recorder Co.

Registers and Fittings
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Ohmer Fare Register Co.
Rooke Automatic Register Co.

Reinforcement, Concrete
American Steel & Wire Co.

Repair Shop Appliances. (See also Coil Banding and Winding Machines)
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Repair Work. (See also Coils)
Cleveland Armature Works
Columbia M. W. & M. I. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Replacers, Car
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Resistance, Grid
Columbia M. W. & M. I. Co.

Resistance, Wire and Tube
General Electric Co.
Westinghouse Elec. & Mfg. Co.

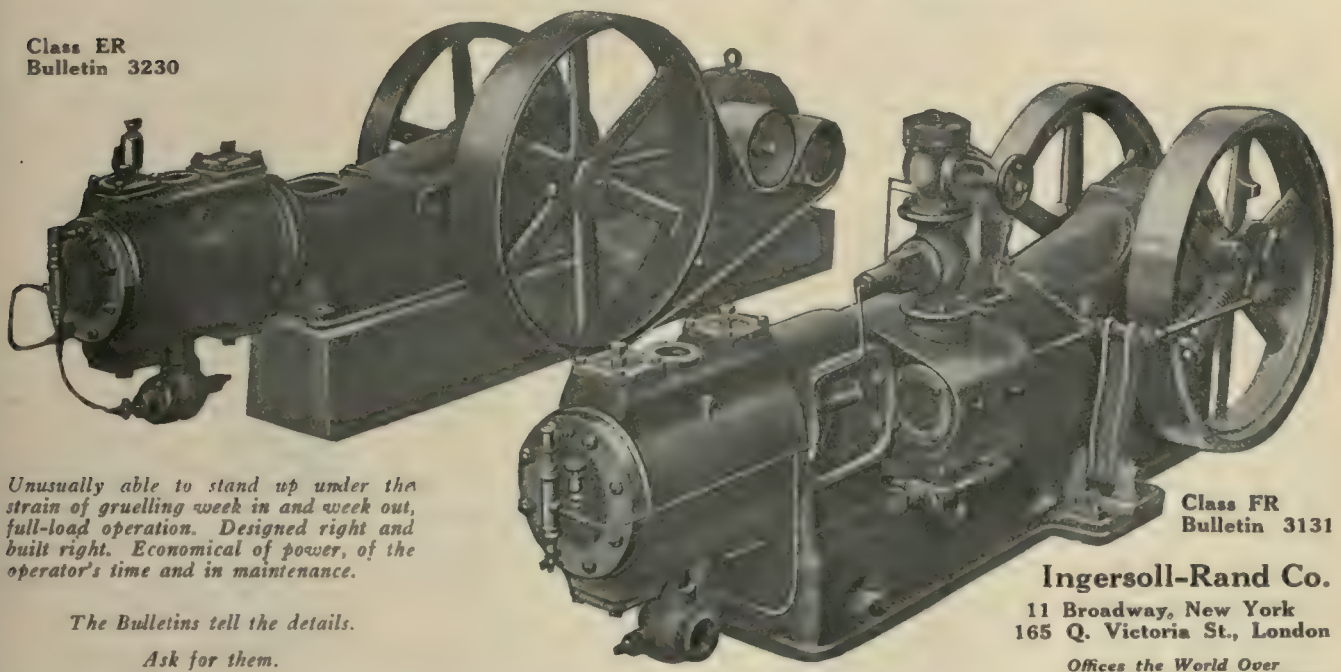
Retrievers, Trolley. See Catchers and Retrievers, Trolley)

Rheostats
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Rubber Specialties of all Kinds
U. S. Rubber Co.

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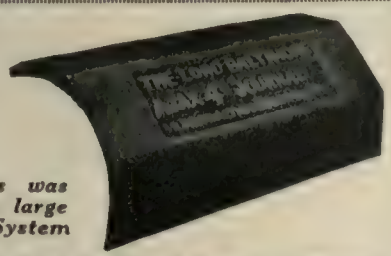
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They are metals that give good service.

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Now the
ONE-MAN SAFETY CAR
has arrived, start right with

Standard Patterns Reinforced Brake Shoes

Pattern No. D-67, 2¼ inches to 2½ inches wheel treads; for narrow heads.

Pattern No. D-87, 2¾ inches to 3 inches wheel treads; for wide heads.

And use Solid End Plate Brake heads for Efficiency and Economy.

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332 S. Michigan Ave., Chicago Chattanooga, Tenn.

WHAT AND WHERE TO BUY

Sanders, Track
Brill Co., The J. G.
Cleveland Fare Box Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Ohio Brass Co.
St. Louis Car Co.

Sash Fixtures, Car
Brill Co., The J. G.

Sash Metal, Car Window
Hale & Kilburn Corp.

Scrapers, Track. (See Cleaners and Scrapers, Track)

Screw Holes
Stine Screw Holes Co.

Seats, Car. (See also Rattan)
Brill Co., The J. G.
Hale & Kilburn Corp.
Peters & Co., G. D.
St. Louis Car Co.

Second-Hand Equipment
Archer & Baldwin
Cleveland Armature Wks.
Foster Co., L. B.
Griswold Machine Co., G. M.
Hyman Michaels Co.
MacGovern & Co., Inc.
Zelnicker Supply Co., Inc., Walter A.

Shades, Vestibule
Brill Co., The J. G.

Shovels
Hubbard & Co.

Shovels, Power
Allis-Chalmers Mfg. Co.
Brill Co., The J. G.

Signals, Car Starting
Consolidated Car Heating Co.
Electric Service Supplies Co.
National Pneumatic Co., Inc.

Signal Systems, Block
Electric Service Supplies Co.
Nachod Signal Co., Inc.
Union Switch & Signal Co.
U. S. Electric Signal Co.
Wood Co., Chas. N.

Signal Systems, Highway Crossing
Nachod Signal Co., Inc.
U. S. Electric Signal Co

Slack Adjusters. (See Brake Adjusters)

Sleet Wheels and Cutters
Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Columbia M. W. & M. I. Co.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
More-Jones Brass & Metal Co.
Nuttall Co., R. D.

Snow-Plows, Sweepers and Brooms
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Consolidated Car Fender Co.
McGuire-Cummings Mfg. Co

Soldering and Brazing Apparatus. (See Welding Processes and Apparatus)

Solderless Connectors
Frankel Connector Co.

Spikes
American Steel & Wire Co.

Splicing Compounds
U. S. Rubber Co.
Westinghouse Elec. & Mfg. Co.

Splicing Sleeves. (See Clamps and Connectors)

Springs, Car and Truck
American Steel Foundries
American Steel & Wire Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Standard Steel Works Co.
Taylor Electric Truck Co.

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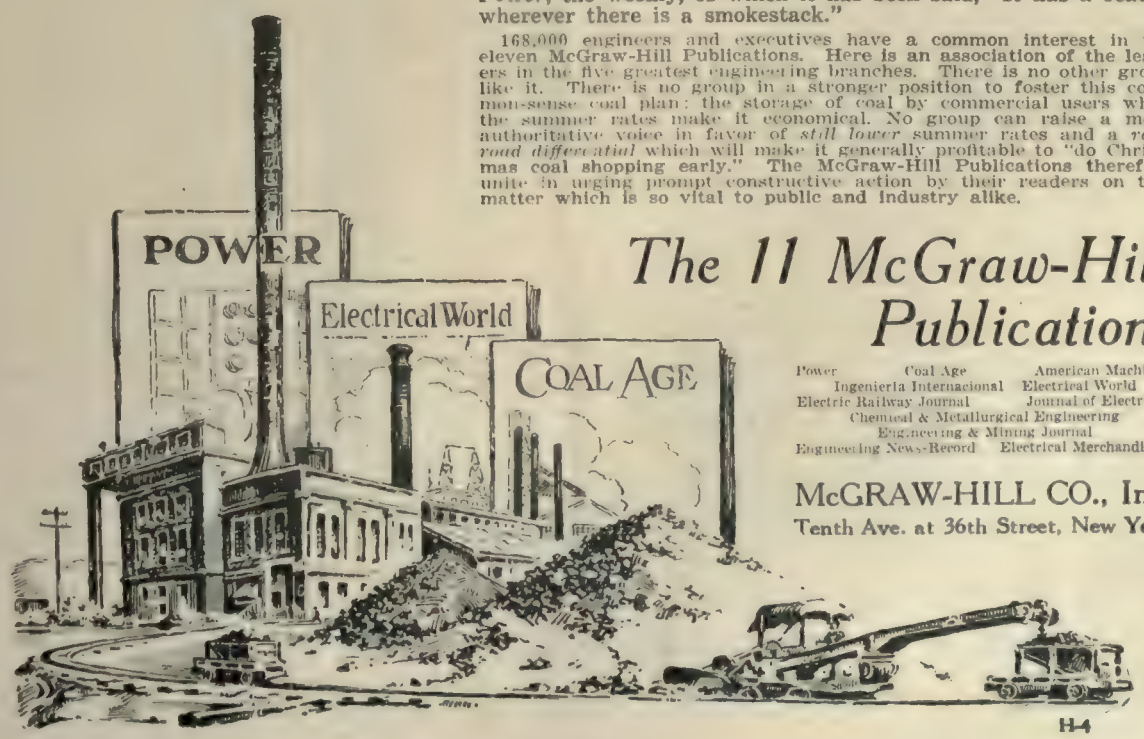
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Herbert C. Hoover put this problem squarely up to American industry through the American Institute of Mining and Metallurgical Engineers in opening, on February 17th, the Forum on the Stabilization of the Coal Industry.

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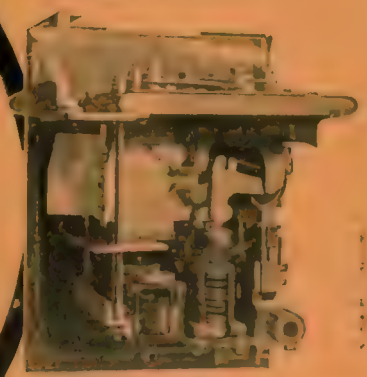
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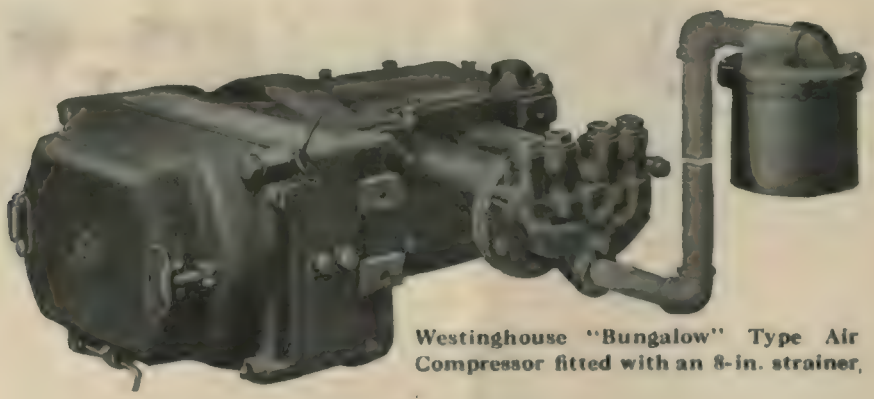
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Efficient maintenance of the Air Compressor is forwarded by providing a good Air Strainer



Westinghouse "Bungalow" Type Air Compressor fitted with an 8-in. strainer.

A Good Air Strainer

must be one which, while performing its function of straining the air being drawn into the compressor, will not restrict and reduce the intake of air at the strainer, either by insufficient screen area or by clogging up of the strainer. These two evils, common to air strainers, are avoided in the Westinghouse 8-inch type. Its large screening area permits a gentle flow of air to the compressor, and its practical construction makes easy the process of disassembling to remove collected dirt.

Air Brake Building Our Business For a Lifetime

Westinghouse Traction Brake Company

General Offices and Works: Wilmerding, Pa.

Boston, Mass.
Chicago, Ill.
Columbus, O.
Denver, Col.
Houston, Tex.
Los Angeles, Cal.
Mexico City
New York, N. Y.
Pittsburgh, Pa.
San Francisco
Seattle, Wash.
St. Louis, Mo.
St. Paul, Minn.
Washington, D.C.



It Pays to Add Service

when you use

Safety Car Control Equipment

Service, *service* and still more service is the answer to automobile competition whether public or private.

But there is only one way to give that additional service at a profit.

That way is to equip your cars—whether new or old—with Safety Car Control Equipments.

By enabling you to use one operator instead of two, and to run the cars on shorter headways with notable improvements in speed and safety, our Safety Equipments permit you to—

Recapture and create traffic that is obtainable only through short-headway operation.

SAFETY CAR DEVICES CO.

Main Office—Boatmen's Bank Bldg., ST. LOUIS, MO.

CHICAGO Railway Exchange Bldg. | WASHINGTON, D. C. Munsey Bldg. | NEW YORK City Invest. Building | PITTSBURGH Westinghouse Building

CANADA—Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Phono-Electric in Bustling Houston



The installation of Phono-Electric Trolley Wire on portions of the main belt of the Houston (Texas) Electric Company is a characteristic way of introducing this long-lived, smooth-contact trolley wire.

The railway naturally puts it up first where its "Make-Good" qualities will tell soonest in comparison with copper; and where continuity of service counts more than on individual lines.

Many railways which began like Houston have since put up Phono-Electric Trolley Wire on the greater part of their mileage.

You can't lose by putting up some Phono-Electric over your heaviest lines. Thereafter you will sell yourself!

Bridgeport Brass Company
Bridgeport Connecticut

2114

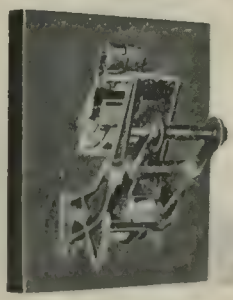
NATIONAL TROLLEY GUARD

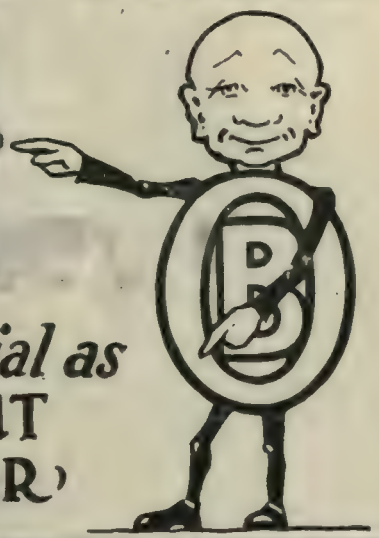
It is cheaper to buy a circuit breaker than to replace a generator damaged by a short circuit.

It is cheaper to buy National Trolley Guard than to replace a car and settle damage suits for injuries.

National Trolley Guard is an inverted trough of open wire mesh placed over the trolley at railroad crossings. It catches the wheel when it jumps and furnishes power to take the car into the clear.

Send for "Guarding the Grade Crossings"



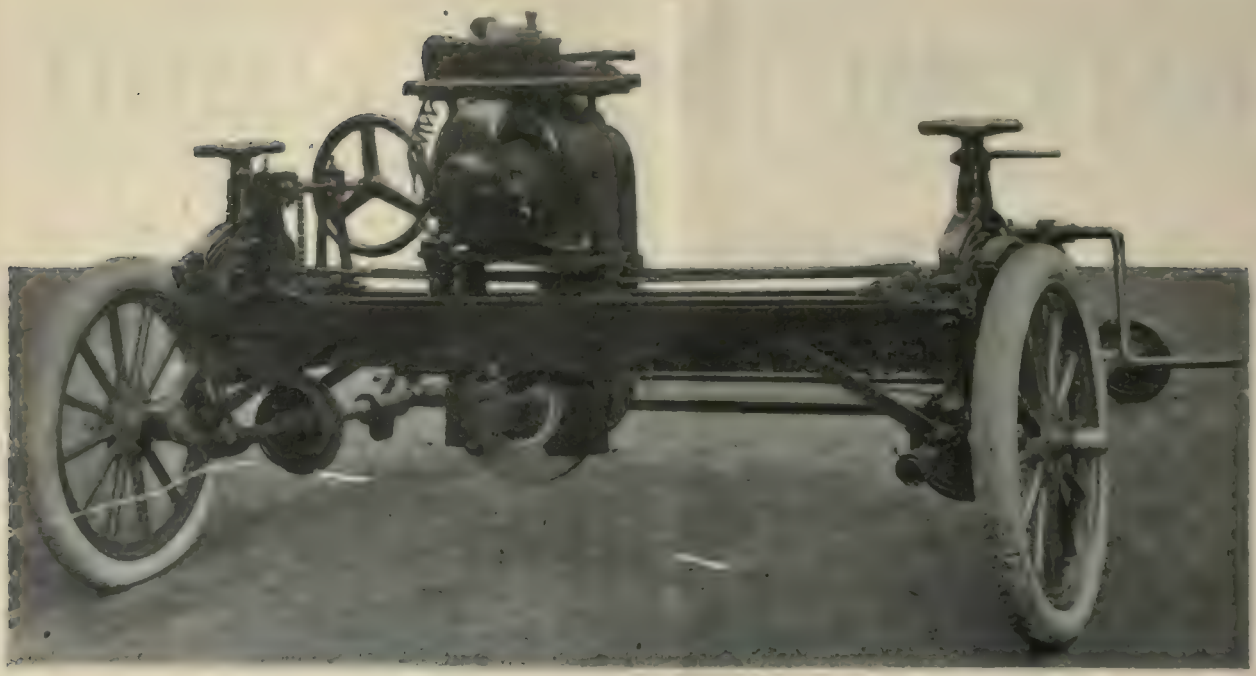


As Essential as a CIRCUIT BREAKER

The Ohio Brass Co.
Mansfield, Ohio

New York, Pittsburgh, Los Angeles, San Francisco, Philadelphia, Chicago





Will Grind Rail Head at Any Angle

This feature is of great importance in grinding off built up joints such as are made with the arc welder. It is one of the outstanding features of

The Universal Rotary Track Grinder

Other important features are:

An outboard bearing on the grinding wheel arbor.

Large pneumatic tired derail wheels.

Easy adjustment of all parts.

Easy operation—

Direct Drive Motor

Low Working Economy

Other *track grinders* for all kinds of track grinding.

Send for details

RAILWAY TRACK-WORK CO.

3132-48 East Thompson St., Philadelphia

Exclusive Agents—West

ATLAS RAILWAY SUPPLY CO
Chicago Ill

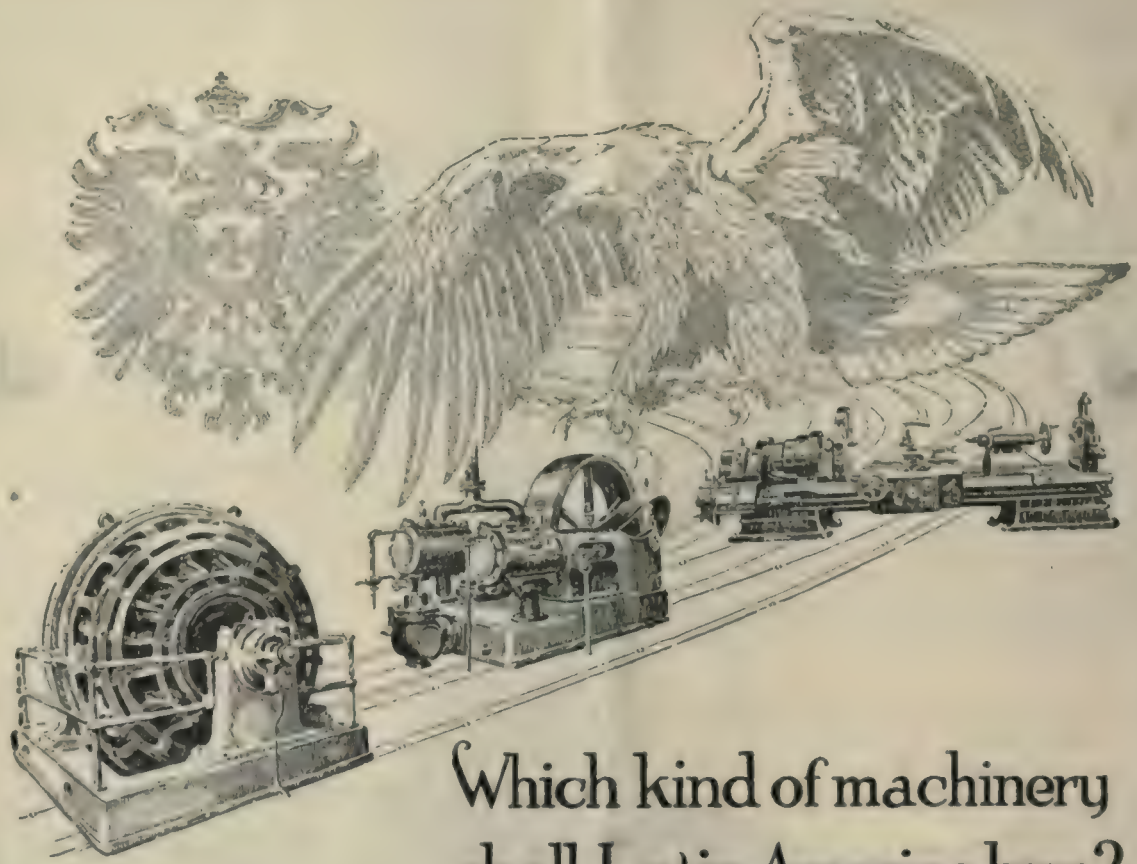
ELECTRICAL ENGINEERING & MANUFACTURING CO
Pittsburgh Pa

Exclusive Agents—New England

CHAS. N. WOOD CO
Boston Mass

HITCHCOCK, LLOYD & CO. Inc.
77A Queen Victoria St. E. C.
London, England


Heavier Sections used throughout in
INTERNATIONAL
STEEL CROSSING FOUNDATIONS
THE sections used in building the box girders which, filled with wood, make up STEEL CROSSING FOUNDATIONS have been increased in weight until the box weighs nearly one hundred (100) pounds per foot.
Seven inch by 14¾ pound Channels as side members are riveted together with ¼-in. rivets and ⅜-in. top and 7/16-in. bottom plates; into the box thus formed creosoted wood blocks are pressed with the grain vertical.
But by fortunate purchases of Government destined steel the prices we are quoting are held to a very attractive figure.
Large re-orders of *International Steel Crossing Foundations* are now being built for Electric Railways.
Let us prepare proposal plans and estimates for your renewals.
The International Steel Tie Company
Manufacturers of Steel Twin Ties and Crossing Foundations
General Sales Office and Works: Cleveland, Ohio



Which kind of machinery shall Latin-America buy?

WHY was it—back in 1914 before the World War broke loose—that out of $3,000,000 worth of electrical supplies imported by Chile, Peru, Cuba, Porto Rico and Bolivia, nearly half of the material came from Germany?

And when, in 1913, Argentina imported $62,000 worth of lathes, $44,000 worth of them came from Germany and France. Why was *that?*

In the same year Argentina bought $990,000 worth of steam boilers from England and Germany. From the United States she purchased boilers worth only $15,000. What's the answer?

It's just a question of engineering methods and standards. As long as Latin-American engineers think first in terms of European practice it will be easier for them to use European engineering equipment than American products. And they will buy that which they can use most easily.

Our job is to foster *American engineering thought* in the minds of our purchasing neighbors to the South. To the extent that we are able to convey to them American ideals, American adaptability and American enthusiasm in things engineering—to just that extent we shall be able to build demand for American machinery and engineering equipment.

From the first page of its first issue, *Ingeniería Internacional* has understood this situation and has set about in a spirit of constructive sympathy to tell the purchasing engineer and executive of Latin-America the things he needs to know about American achievement and the splendid products this achievement has brought about. And *Ingeniería Internacional* is getting results.

THE 15,000 copies of *Ingeniería Internacional*, issued each month, go to leading engineers in the Spanish-speaking countries. More than 225 manufacturers of machinery and equipment are now making advertising space in *Ingeniería Internacional* a regular part of their Latin-American and Spanish sales plans.



Ingeniería Internacional

One of the 11 McGraw-Hill Publications

McGRAW-HILL CO., INC. TENTH AVENUE AT 36th ST., NEW YORK

London Chicago Cleveland Washington Buenos Aires Philadelphia San Francisco

H-3



And if your apparatus is burnt out by lightning this summer, replacement will be quite impossible without a long interruption of service. Besides your apparatus has doubled in value and it is to your interest to increase your protection.

Garton-Daniels Direct Current Lightning Arresters have proved their efficiency by 29 years of service. They are used the world over by electric railways—you see them installed wherever you go.

Write for Bulletin No. 163

ELECTRIC SERVICE SUPPLIES CO.

Manufacturer of Railway Material and Electrical Supplies

PHILADELPHIA
17th and Cambria Sts.

NEW YORK
50 Church Street

CHICAGO
Monadnock Building



How is the life of the rail prolonged by the

Resiliency

of Dayton Mechanical Ties?

The cushion feature of Resilient Railway Ties allows just the right amount of rail deflection. Always the same; in the frozen ground of Winter or the soft thawing of Springtime. This lessens rail crystallization.

The joint tie supports the rail ends from the base of the rails and on exactly the same level. Broken down joints and battered rail ends impossible.

THE DAYTON MECHANICAL TIE CO., 704 COMMERCIAL BLDG., DAYTON, OHIO



Anaconda Copper Wire is made in a wide range of sizes and in every degree of hardness.

The special processes which Anaconda has standardized in the manufacture of copper wire insure a product having high tensile strength and good elongation without any tendency to brittleness.

Anaconda Copper Wire is drawn from the famous B & M Brand Electrolytic Copper Bars, which contain less than 1 100 of 1% metallic impurities.

Allow our engineers to figure on your requirements when new work is contemplated.

Anaconda Copper Mining Company

Rolling Mills Department, Great Falls, Montana
General Office: Rolling Mills Department, Chicago

Photo Courtesy C. M. & St. P. Ry.





ANACONDA Copper Wire

"From Mine to Finished Product"



THERMIT-WELDED Special Work

Means Less Need for Higher Cost Track and Paying Labor

In 1914 one of our large Eastern railways was paying common track labor 17 to 22 cents an hour. In 1919 the same company was paying the same class of labor 44 to 50 cents an hour.

And, of course, the earnings of this railway have not gone up in anything like the same proportions. Indeed, it's bankrupt.

Compared with platform labor, the wages of trackmen may not bulk large in the eyes of the management but this is a time when every dollar that can be saved must be saved.

To Save Both Installation and Upkeep Labor You Need
THERMIT-WELDED Special Work

Through the fact that a Thermit-Welded layout can be put down in as large units as you can conveniently transport from your shops and through the fact that no complex adjustments are required, you save labor-time in *installation*.

Through the fact that there are no bolts and plates to loosen, once the layout is in place, you have no expense for taking up paving, tightening fastenings, replacing paving, etc., thus saving labor-time in *upkeep*.

Furthermore, the less dependence you have to place on man power in these days of downright labor scarcity, the better off you are.

Thermit-Welded special work is easily made in your own shops of any materials that you choose to use.

Just advise us what rail sections you use and how many crossings of each you wish to make, and we will quote you prices at once. The permanent Thermit equipment can also be used for welding compromise joints, broken motor cases, truck frames, armature shafts and many other heavy steel sections.



Metal & Thermit Corporation

Pittsburgh
Chicago

120 Broadway, New York

San Francisco
Toronto



Aluminum Conductors

mean to every Electric Railway a large saving in high tension line costs.

The initial cost *is less per mile* than any other conductor of equivalent conductivity.

The final cost *is less*, due to the extreme light weight of the aluminum, which reduces unnecessary strain on all pole line equipment.



Aluminum Company of America · Pittsburg Pa. U·S·A·

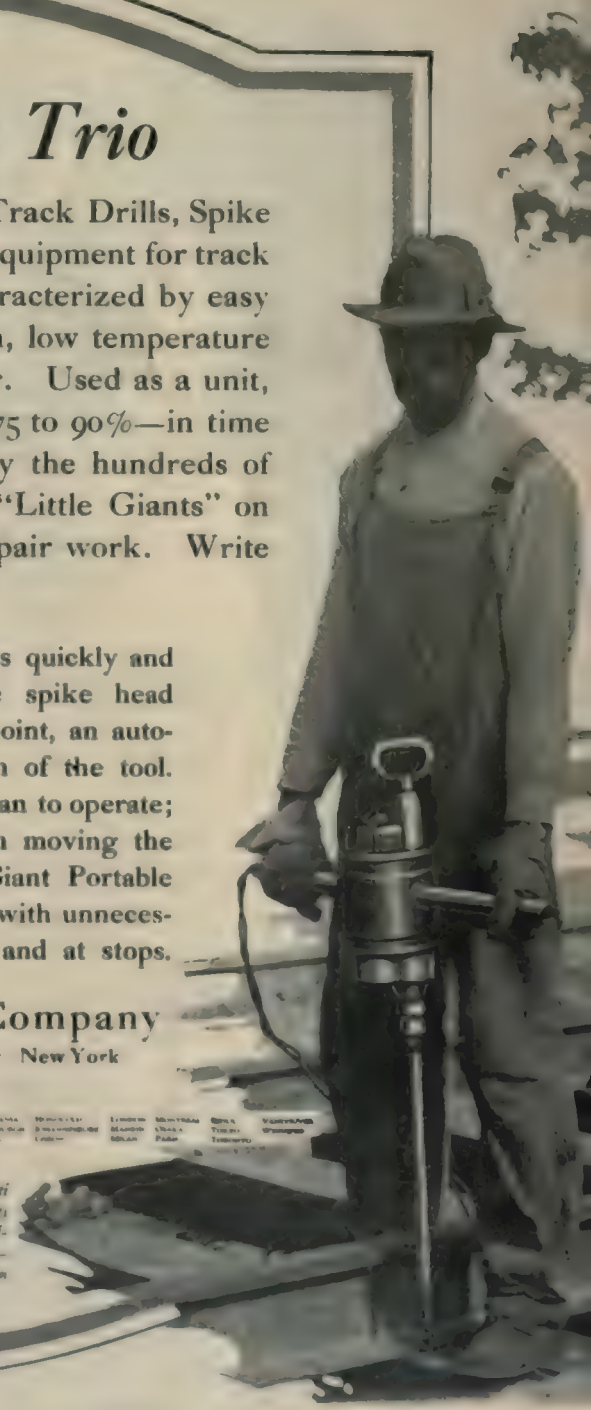
The Ideal Track Trio

LITTLE Giant Portable Electric Drills, Track Drills, Spike Drivers and Grinders, form the ideal equipment for track construction and maintenance. All are characterized by easy control, accessibility of parts for inspection, low temperature rise and extreme portability for their power. Used as a unit, this team will accomplish a saving of from 75 to 90%—in time and labor conserved—a fact established by the hundreds of Little Giant track tools now in use. Get "Little Giants" on the job for *your* spring construction and repair work. Write for Bulletins.

Little Giant Spike Drivers set screw spikes quickly and economically. When the tension of the spike head against the rail reaches a predetermined point, an automatic circuit breaker stops further rotation of the tool. Little Giant Track drills require but one man to operate; it is best to have another man to assist in moving the drill from one point to another. Little Giant Portable Grinders make joints smooth and do away with unnecessary track wear and vibration on curves and at stops.

Chicago Pneumatic Tool Company

Chicago Pneumatic Building · 6 East 44th Street · New York



This Little Giant unit at work for the Cincinnati Traction Company is one of two such complete units which, according to Mr. J. V. Hyson, Superintendent of Construction, are giving "excellent results—more ordered." Construction units never change from Little Giants

BOYER PNEUMATIC HAMMERS · · LITTL
CHICAGO PNEUMATIC AIR COMPRESSOR
· GAS AND STEAM ENGINES

CHICAGO CP PNEUMATIC

LITTLE

Electric Tools for



EL-29

GIANT PNEUMATIC AND ELECTRIC TOOLS
VACUUM PUMPS · · GIANT FUEL-OIL,
· ROCK AND COAL DRILLS ·

CHICAGO PNEUMATIC

GIANT

Shop and Track

This Track is Properly Equipped for Good Service and the

Abbott Rail-Joint Plates

Eliminate Much Useless Maintenance Expense



The Abbott Plate installations shown were made in New Jersey in 1913 on main line track of one of the leading American railroads. Part of the rails at this location were new and part old at that time, and since then although all the track here has been relaid, there have been no removals of Abbott Plates. The trackwalker said that during the two years he had worked on this section, he had never had occasion to tighten a loose bolt, nor had he ever found a nut gone when Abbott Plates were in use.

These Abbott Plates are still apparently as efficient as when first laid and nothing has ever developed that would indicate a life for the plates that is any shorter than that of the rails.

The plates used on this road are of our special upturned flange pattern, with no part depending below the tie tops. Some engineers prefer this type in the belief that the upturned flanges, out of intimate contact with the ballast, are a protection against electrical losses in track carrying current for block signals, etc.

These plates may be used with a full complement of screw spikes as shown or with common spikes or a combination of both, and through the upturned plate ends, have the same anti-creeper qualities as our standard pattern with reversed flanging.



The upturned flange type also has the slight camber at the center, which makes the full load bear directly on the base of the rail end, and which, through the elasticity of the plate, permits the load to depress the rail end *only enough to bring the joint under load into true*





surface. There is only enough looseness of the joint to permit the free wave movement that is essential to freedom of the joint parts from harmful strain.

If you contemplate the laying of new rails or are looking for the right way to get more and better service from worn old rails, have our engineers explain in detail what could be accomplished by installing Abbott Plates and at what cost. Also ask for our booklet "Lackawanna Improved Track Appliances."

For Railroad Construction Work

Lackawanna Steel Sheet Piling

Thousands of tons of Lackawanna Steel Sheet Piling are used by American Railroads for construction and permanent protection of bridge piers, temporary and permanent retaining walls, grade elimination work, etc.

DOUBLE-LOCK LACKAWANNA INTERLOCK

Lackawanna Sections are made in a wide range of types and sizes from which one can be selected for safety and economy under practically any conditions.

The Lackawanna Flexible Interlock is not only superior in strength and water tightness but permits obstructions in the piling line to be passed without undue deflection and is adapted to the construction of irregular walls and small circular enclosures.

Our Sheet Piling Engineers will gladly co-operate with railroad construction officials in determining the most desirable methods and sections for difficult work and will submit valuable cost data.

Send for our Book "Lackawanna Steel Sheet Piling"

Elcannes Concrete Reinforcing Bars



The broad and deep depressions at regular intervals in the bar surface take the place of excess and waste metal comprising the projections on ordinary types of deformed bars.

The bonding surface of the Elcannes Bar is 15 per cent greater than that of a plain square bar of the same nominal size.

The Elcannes Bar is uniformly designed, the deformations being so arranged on opposite sides of the bar that a practically unvarying cross-sectional area is maintained.

The regular surface and uniform section render handling easy and reduce the difficulty of fabrication or bending in shop or field.

The Elcannes Bar is manufactured exclusively by the Lackawanna Steel Company. Send for complete information

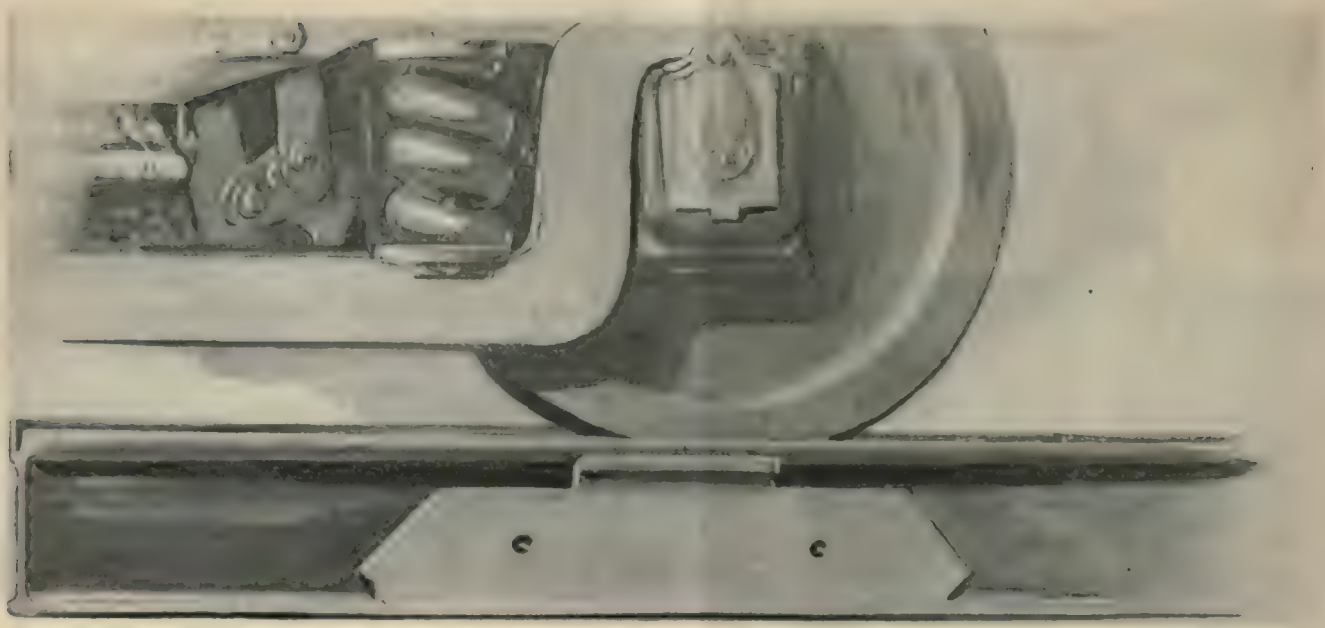
Lackawanna Steel Company

General Sales Office and Works: Lackawanna, N. Y.

Atlanta Boston Buffalo Chicago Cincinnati Cleveland Detroit New York Philadelphia St. Louis San Francisco

Sole Exporter of Our Commercial Products: Consolidated Steel Corporation, 165 Broadway, New York.

486



Under Maximum Wheel Load
a deflection of but .018 in.

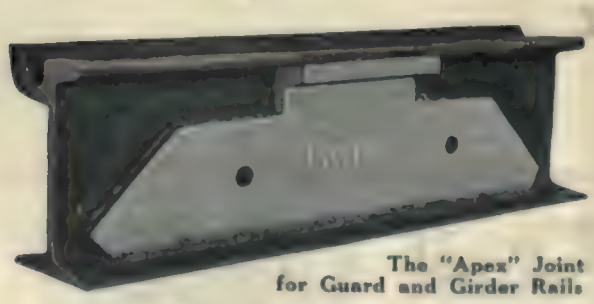
This was proven in a deflection test made by Robert W. Hunt & Co., of Chicago, on an

INDIANAPOLIS
"Apex" Joint

A test of the "Simplex" Joint made by the Bureau of Standards, Washington, D. C., showed the conductivity of this joint as 138 against 100 on unbroken rail.

Therefore Eliminates Bonds

Not merely these two tests, but the evidence of their satisfactory use by more than 100 electric railways should lead you to try Indianapolis Joints on your own track. Efficient and economically applied with the Indianapolis Electric Welder.



The "Apex" Joint for Guard and Girder Rails



"Apex" Joint for Tee Rail

INDIANAPOLIS SWITCH & FROG CO.

Springfield, Ohio



National Pneumatic Door and Step Control

Means Less Delay in Congested Streets

A good deal of the lower schedule speed due to traffic congestion can't be helped; but some of it can.

For example: Higher rates of acceleration and braking as well as quicker closing and opening of doors reduce the losses due to traffic congestion, because they *save the seconds.* And seconds count when you consider that in a congested section a car is likely to stop at every block to take on or discharge passengers.

Therefore, it is necessary for both motorman and conductor to be able to take advantage of any clear space up ahead and to be able to respond *instantly* to the traffic officer's *"Go-Go".*

The use of laborless, practically instantaneous National Pneumatic Door and Step Control, including Safety Interlocking features, assures you that your men will have incentive to take advantage of every opportunity to save time because it's so easy for them to do it.

Whether you are installing National Pneumatic Door Engines alone or as a part of the famous Safety Combination of the Safety Car Devices Company, we urge that you also use the door shaft and step shaft devices of the National Pneumatic Company to secure the smoothest and most reliable operation possible with National Pneumatic Door Engines.

NATIONAL PNEUMATIC COMPANY INC.

50 Church St., New York **Edison Building, Chicago**

Works: Rahway, N. J.

HABIRSHAW

"Proven by the test of time"

Insulated Wire & Cable



Habirshaw Concentric Paper-Insulated Lead-Covered Cable

Heavy Current—Minimum Diameter Concentric Cable

CONCENTRIC cable is desirable for low voltage underground service where a large amount of copper is required and a minimum diameter necessary to secure efficient use of ducts. Insulating the negative feeder helps to keep down electrolysis, and associating it with the positive feeder in one cable eliminates destructive "grounds" by affording a direct short-circuit path which will cause the circuit breaker to open at once.

Habirshaw concentric cable is used by some of the largest and most progressive lighting and railway companies.

Habirshaw Wire Manufactured by
Habirshaw Electric Cable Co.
Incorporated
10 East 43rd Street, New York



Habirshaw Wire Distributed by
Western Electric Company
Incorporated
Offices in All Principal Cities

Paper Insulated Cable
Round Conductor Cables
Sector Cables

Varnished Cambric Insulated Cables
Armored Cables

Rubber Insulated Cables
Code (Black Core)
Intermediate (Red Core)
30% Hevea R. S. A. Standard

Metal Tickets Make Your Multiple Coin Fare Collection as Simple and Positive as the Old Five-Cent Fare

Until necessity forced the retirement of the old five-cent fare standard, there was no need for ticket fares except on some properties where they were required by ordinance. With the coming of odd-cent and fractional-cent fares the use of tickets was imperative. Paper tickets could not be properly accounted for, and the situation had to be met with *metal tokens which could be registered the same as any coin in a fare-box.*

That *results have been entirely satisfactory* was vouched for by numerous railway men at the recent Atlantic City Convention.

Among the ***Advantages cited for Metal Tickets*** *were these:*

Their use permits charging fares involving fractions of a cent and the transfer from one fare schedule to another without change of coin.

Amount of cash handled by conductors is reduced to a minimum and the chance for errors or dishonesty is reduced to a minimum.

Company receives a large portion of its receipts prior to time service is rendered to customer.

Their use tends to decrease congestion in loading because change making is not required, and this decreases length of stop and makes for faster schedules; also permits conductors to give more attention to other duties.

Their use tends to encourage riding habit because experience shows it easier to part with a ticket than to "break" another coin.

It is easier to examine metal tickets than multiple fare units on the inspection plate of fare-box.

Metal tickets outlast any other tickets and it is difficult to counterfeit them.

Any fare value may be placed on a metal ticket, and the modern type of fare-box will record the exact amount represented

The work of accounting department is simplified.

We have been furnishing metal tickets to our customers for several years past.

Orders for metal tickets from properties adopting this system of fare collection are being received constantly.

We will be pleased to give the names of these companies and to quote prices upon request.

JOHNSON FARE BOX COMPANY

Jackson Boulevard and Robey Street, Chicago
50 East 42nd Street, New York



The Car Card is judged by its results.

Good car cards keep advertisers satisfied because they produce increased sales.

Collier Service

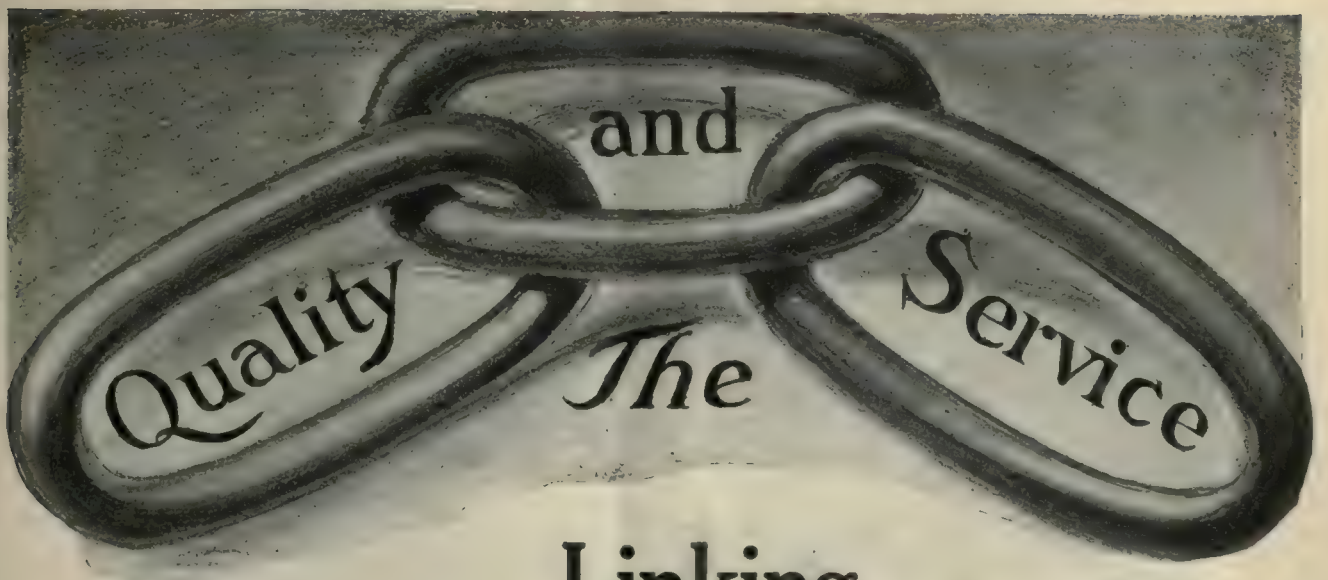
is the concentration of the best advertising ideas and plans applied to car cards.

To the electric railway this means a regular monthly check which assures a permanent and steady income. Collier Service is nation wide in scope. It reaches all and serves all

Barron G. Collier
INCORPORATED

Candler Bldg., New York





Linking of Two Essentials

A good dinner poorly served is almost as unsatisfactory as a poor dinner—no matter how complete the service may be.

The reason that Galena Service proves so satisfactory and desirable is because it works hand-in-hand with Galena Quality.

Galena Oils are recognized as the lubricants without a peer simply because they are made of the highest grade materials that the market produces, compounded by Galena processes—methods perfected by fifty years of test and research, and used exclusively by this company.

Galena Service produces the exceptional results in lubricating efficiency that the records show—not alone through its unusual facilities for knowing how and showing how, but because it is used in connection with the supreme Galena Quality Oils.

Galena Quality hitched to Galena Service makes an incomparable team.

1

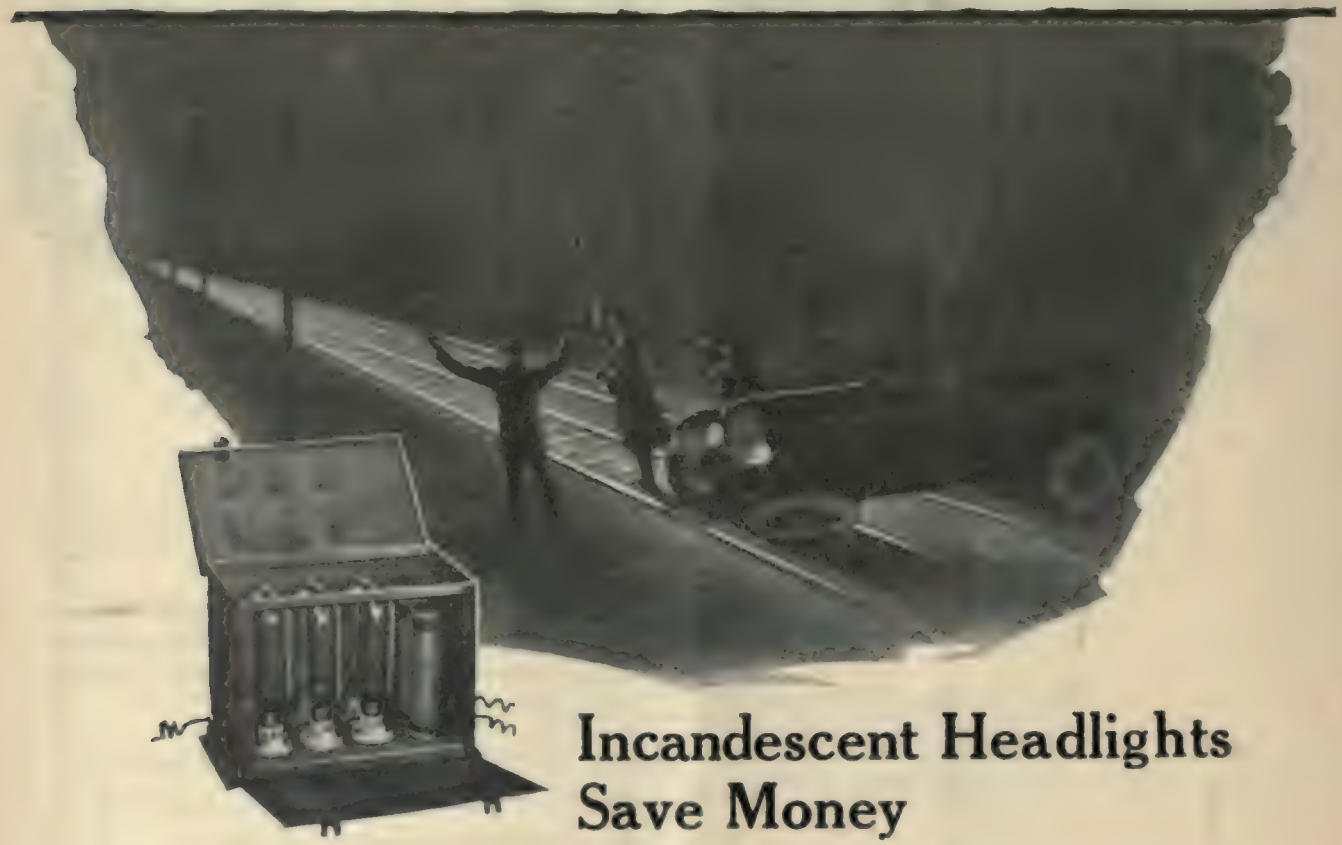
Galena-Signal Oil Company

New York *Franklin, Pa.* *Chicago*

and all principal American cities

LONDON TORONTO BUENOS AIRES MONTREAL PARIS

For an adequate return upon investments electric railways must reduce operating costs to the minimum consistent with safe and efficient operation.



Incandescent Headlights Save Money

The master mechanic of a large railway property stated recently that his incandescent headlights with GECO resistors save his road the wages of at least one man, released for duty elsewhere. This is because incandescent headlights require no expert attention for maintenance or repairs.

Despite this fact, they are highly effective when used with GECO resistors which maintain practically constant current regardless of trolley voltage fluctuations. This low maintenance and absolute reliability, the prime requisites of an efficient headlight, are satisfied by this type of equipment.

GECO Lights Are Always Bright

Ask our nearest office for Bulletin 63800 and the expert advice of our railway specialists

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

85C 55

Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Volume 55 New York, Saturday, April 10, 1920 *Number* 15

Need for Better Fire Brick Becoming More Pronounced

THE recent experiments with the use of pulverized coal for fuel in large generating stations has pointed clearly to the great need for ceramics research work looking toward the development of a fire brick which will provide a furnace lining capable of withstanding the very high temperatures that can be secured through this manner of combustion. Even with stoker operation, the furnace lining has been a source of great trouble for some years past, particularly in installations where it becomes desirable to force the boilers to about 250 per cent overload. It is highly desirable to be able to force boilers to several hundred per cent of their rating continuously, in some cases, and temporarily in nearly all cases, in connection with the electric railway and central station fields. The fire bricks available today, however, place a limitation upon the permissible furnace temperature. This limitation is more pronounced with pulverized fuel burning than it has been with stoker-fired boilers. In fact, it represents a limitation which mitigates against the best combustion efficiency. In other words, were it not for the limitation of the fire brick lining it would be possible to obtain almost perfect combustion with pulverized coal. This points to the great desirability of development work looking toward fire brick capable of withstanding much higher temperatures than can be permitted at present—a subject which might well be taken up by the fire brick manufacturers, the industrial research laboratories of the universities and other investigatory bureaus.

Are We Being Talked to Death?

GEORGE McMANUS is the author of "Bringing Up Father." Into his work he has packed a great deal of common sense. George pictures one of his characters in a barber shop. The man is being shaved. On his watch fob he has a bear's claw. The barber asks his patron how many shots it took to kill the bear. The patron answers that it didn't take any. The barber asks how many times the patron stabbed the bear. The patron answers none. Finally, the barber, bound that he will know how Bruin met his fate, asks how the patron did kill the bear. Then in desperation the patron replies, "I talked him to death."

Now, the United States is not exactly being talked to death, but it is being talked insensate. Nearly everybody is emulating Mr. McManus' barber. Industry seems to be divided—not equally by any means—into two general classes, those who work and those who pretend to work. They who pretend to work are the culture of courage crowd. Their middle name is Con, with a capital C. The former are too busy to believe in anything. The latter are too talkative to do anything. Their idea of emulating the boss is to convert themselves into a hot-air machine. They are the great pretenders. The human hot-air engine can be endured in politics, but he has no place in business. The sage of East Aurora made Rowan, his hero, the embodiment of action. The lesson of that little booklet had a salutary effect. Its circulation ran into many millions. It ought to be revived and a copy placed in the hand of every employee who has been led astray with the doctrine that appearing to be something you are not is the same as being that person. The culture of courage school will awaken to that fact sooner or later, but it might be well to accelerate the awakening. It would solve one of our national problems and remove a pest.

Don't Economize (?) by Cutting Down on Brain Power

IN GENERAL, superficially at least, the public appreciates brawn more highly than brain when it comes to public service. That is to say, it does so in comparison with the practice of the utilities and especially with that of the manufacturing and constructing companies. For example, a municipality expects to get technical service for a price very much lower than that paid privately for such services. The result is that, excepting under emergency circumstances which appeal to the public spirit of high-grade specialists among the citizens, only mediocre talent is available for public service.

One of the arguments, a specious one, in favor of public ownership and operation of utilities is that administration can thus be conducted more economically as far as the salary list is concerned. This short-sighted economy takes the form of low salaries and inadequate personnel. Mr. Hanson told the Toledo people a few weeks ago that one result of public ownership and management is that "low-priced managers put the business amounting to millions of dollars annually into the hands of wornout employees or young apprentices in electric railway operation." It is interesting to note that in Seattle recent economies on the municipal railway system take the form of the acceptance of resignations of three department heads and the abolishing of fourteen positions, thus saving $2,885 per month. In investigations of utility affairs generally the officials representing the public are usually much shocked by the magnitude of the salaries paid company officers by boards of directors who know that sometimes expensive things are cheapest. Yet these salaries are small measured by the ability of the recipients to save or lose vast sums for their employers.

This note is not an argument against public ownership and operations *per se*. It rather is a note of warning that the cutting down in the brain power of

any organization is killing the goose that lays the golden egg. As the Russian Soviet Government learned months ago, and, learning, profited thereby, brains must be had no matter how high they come. And they are coming mighty high in Russia today.

Oregon May Delay, but the Bill Must Be Paid Some Day

IN RATHER sharp contrast to the action of some other commissions, such as Maryland in the case of the Baltimore United Railways and Virginia in the case of the Norfolk City Gas Company, is the action of the Public Service Commission of Oregon in the Port and Railway case. In its opinion of March 23 it holds in suspense for at least two months more its decision on a fare increase which was requested last September. To be sure, the commission admits and proves that some relief must be given the company either by its riders in increased fares or by the public in taxes. But the delay in providing this opportunity to continue as a going concern is deadly.

We were about to add the Interstate Commerce Commission to the list of guilty on the same charge on account of its 120-day postponement of allowing the Hudson and Manhattan 8-cent fare relief requested, when the commission intimated that meanwhile it would allow relief according to an alternate fare scheme of 6 cents from New Jersey to lower New York and 10 cents to upper New York.

The reason Oregon delays its decision is that it would have the people of Portland vote on the commission's scheme of municipal ownership of track, thus transferring part of the fixed charges and maintenance costs of permanent way from the car rider to the general public. This, with the removal of street cleaning and other imposts, is its proposed measure of relief to the company.

There may be honest doubt and there should be careful study as to the best form of fare and other financial relations in each case, but to delay giving any relief at all, at the same time that the necessity for relief is acknowledged, is not fair to either company or public. Commissioner H. H. Corey, in dissenting from the majority opinion, argues forcefully on this point as well as against the ultimate measure of relief proposed.

The community eventually pays for what it gets and a mañana policy merely compounds interest, so that when the bill is eventually settled it is worse than it should be, and, too, it may be the next generation that will pay. While searching for the millennium, we ought to pay our own way.

What Has Norfolk Done?

"WHAT has Norfolk, Va., done out of the ordinary?" This query has been put in response to our article on page 682 of last week's issue, "Is not any community willing to assure capital a legitimate return when invested in public utilities?" The answer to this latter question may be, yes, but apparently Norfolk is the first city in the United States to take official corporate action in announcing a policy or platform assuring an inviting return and protection of capital. This act is a definite invitation to the public utility investor, and Norfolk believes that if this attitude toward public utilities is once appreciated, there will be an even greater attraction toward industrial development in such a community which indicates a real conception of business.

"Was not the whole question one of valuation?" Of course, the determination of the investment which is to be safeguarded presents difficult problems. In this connection, we would point out that the present situation in Norfolk is not one in which the city alone has made concession. It has been necessary for the company to approach the problem from the same standpoint as the city, namely, one of fair business dealings between willing parties of integrity on both sides. There will always be honest differences of opinion on the determination of what is the legitimate investment in any enterprise more than one day old. However, a determination on this question must be reached, and when the city and company get together, both with fair minds, both with the same fundamental conceptions as to justice to public and company, at least a basis of agreement ought to be determinable.

To see the extreme of the other side of this continuous question of dealing between cities and companies it is only necessary to turn to the local New York situation, where it is somewhat difficult, to say the least, to determine what the city's attitude is. If, on the other hand, the city would put itself on record as to a definite policy toward public utilities in a manner as fearless as Norfolk, it would at least be possible for both public and company to know where the city stood and to act accordingly.

That there are other examples toward both ends of the scale is not to be doubted, but we believe that the attitude of Norfolk will eventually prove the more advantageous to the community.

Unscrambling Grouped Properties Held Unsound

THE Pennsylvania Commission adheres to a sound policy of economic transportation in its argument on grouped properties in the Pittsburgh Railways case. There were some sixty-three complaints against some sixteen component parts of the operating property, but the commission groups these all into one case, for, it says, the primary consideration to the community as a whole is satisfactory transportation at the lowest cost consistent with sound financial and operating policy, and this can be accomplished only by maintaining the properties as one system. To allow the disintegration of the property into its various component parts, each with its separate fare and with service not articulating with other service, would be almost suicidal to the economic and social welfare of the Pittsburgh district.

To show its sincerity in this viewpoint, the commission proceeded to establish a basis of financial stability for the company so that it would be possible for it to realize the commission's desire of one system. To prove the present fare not excessive, and this was the point at issue in most complaints, the commission said all it needed was the lowest valuation figure offered by any complaint, namely, $48,000,000. But to stop there and say that the property as a whole is worth not less than $48,000,000 would put the company in so vulnerable a position financially that it could not secure necessary funds and would be liable to ultimate disintegration by a series of foreclosures. This would defeat the very purpose of the commission as stated above, namely, to keep the property together. So the commission, although finding it unnecessary for the purpose of the rate case, made a determination of value for the sole purpose of stabilizing the company's financial

status that it might continue as one property, finding the value to be $62,500,000, compared with the company's claim of $70,000,000 and the approximate capitalization of $156,000,000. This, the commission says, tells the company where it stands and allows it to proceed with a constructive program of refinancing and of improving service.

It appears to us that the commission has done a piece of work in line with its constructive policy which we have commended heretofore in these columns.

On one point, however, we wish the commission had been more definite, and that is in its treatment of depreciation and some other details of valuation. As to its subtraction for theoretical depreciation as measured by the physical condition or remaining life of property, the commission does not argue at length, but says it doesn't feel justified in changing its past record and policy. Nor does it say how much it subtracts. If the commission had restated its definite reason for the subtraction and given the amount, even approximately, subtracted for depreciation, it would have faced this issue as squarely as it has the other issues of the situation. We do not criticise the total figure arrived at; it may be perfectly fair. Valuations are hard to determine to any one's entire satisfaction, but it seems entirely probable that more definiteness on the part of commissions as to the exact treatment accorded various items would hasten the day of more nearly complete agreement on valuation methods.

Give the Security Holders Full Information Regarding Operation

THE form of annual report issued by most electric railway companies leaves much to be desired. Usually a condensed balance sheet with brief income statement, in which all operating expenses are grouped in one item, is all that is published. Where the securities of a company are closely held and the company is a small one there is perhaps no reason for the publication of any annual report, because the security holder can get detailed figures of the company's operation by direct application to the company or from its report filed with the Public Service Commission. With a larger company, which prints its reports for circulation among its stockholders, there is every reason why the essential data should appear in its report.

Annual reports, we believe, should contain, first, an income statement setting forth the revenue details and deductions, so as to show the surplus or deficit carried to the balance sheet, with comparative figures for the previous year. The operating expenses should be separated at least into the primary accounts. In the balance sheet the more important assets and liabilities should be detailed and the changes from the preceding year should be shown.

Should the company consider itself in a position to publish a larger report, further interesting information would be data as to the track mileage owned and operated, the different kinds of traffic handled, the number of cars, car-miles and car-hours run, kinds of rolling stock owned, basis of fare schedules and average length of ride and maximum ride possible for the minimum fare. A map is also desirable. If a still larger report is possible there are many ways in which it can be expanded. In fact, we know of one electric railway company which goes so far as to keep a memorandum of a request for information that does not appear on its latest report as a guide to what may be included in the next edition.

Electric railway companies, we believe, have failed to comprehend the advantages that accrue from such publicity. If the report is a favorable one publication of the figures mentioned will increase the company's credit. If the year's operation has been unfavorable the sooner the public knows the facts the better. If there are any persons from whom the company wishes to conceal any facts in regard to its operation they can get the figures, if they desire to do so, at the office of the State Public Service Commission. Hence, the company has nothing to lose and everything to gain by making these figures easily accessible to the general public.

Has Automatic Substation Control Made Good?

INTEREST in the automatic substation would be justified if for no other reason than that it is a real indication of technical progress which promises economy. The electric railway or any other business is stimulating only to the extent that developments are taking place and an improved future service is visualized. The automatic substation is therefore worth while because it meets both of these specifications.

But the automatic substation is more than a promise, more than a harbinger. It has made good—on a small scale to be sure, but on a scale as large as could be expected in six years, half of which were war years. Moreover, the automatic control principle has been found applicable in a field much broader than was originally contemplated.

The automatic control installation most widely heralded, after the pioneer equipments installed on B. J. Arnold's interurban road, was the one in Des Moines, Iowa. Circumstances were propitious there to a remarkable degree for this innovation and the electrical engineer of the local railway property, F. C. Chambers, had the foresight and the courage of his convictions necessary to put the thing over. Back of him was the reputation of a great manufacturing company, staked to the extent to which it was involved in automatic control for electric railways, upon making the proposition a success.

Believing that the time is now fitting for a review of the Des Moines situation, and knowing that its readers want to know, first hand, what has been going on in Des Moines during the four years since the present plan was put into operation, the ELECTRIC RAILWAY JOURNAL asked Mr. Chambers to go over the whole story briefly, stating just what automatic control has done for Des Moines railway service and how it has done it. The response is an article printed this week. Mr. Chambers may later supplement this with more operating detail, and if any questions arise in the minds of the readers of the paper which he does not answer now these might be sent to him or to the JOURNAL so that they can be answered later.

If the automatic substation was desirable before the war it is doubly so now. Attendance costs more than it did; attendants on the average are less efficient, so that it is desirable to turn over all possible operation to automatic apparatus; the equipment has been considerably improved through experience; the limitations and proper fields for automatic control have been discovered, and confidence in the ability of the devices to function properly has been established.

Automatic Substations at Des Moines

Installation of First Two Units Averted Need of New Feeder Cable and Permitted Salvage of Existing Cable—Seven Automatic Stations on City System Installed at Saving of $120,000 in Investment—Equipped with Selector Control

By F. C. CHAMBERS
Mechanical and Electrical Engineer Des Moines City Railway

THE Des Moines City Railway operates 90.43 miles of line, measured on a single-track basis. In the accompanying illustrations are shown the lines composing the system, together with a small portion of the property of the Inter-Urban Railway, which is owned and operated by the same interests but as a separate corporation. The corporate limits of the city of Des Moines include a total of 54 square miles, 9 miles east and west and 6 miles north and south. The lines of the railway company extend outside of the city limits in several directions. The total length outside the corporate limits is 5.2 miles. The business section of the city is somewhat lower than the residence section, so that all cars outward bound from the business section encounter upgrades, the maximum value of these on the different lines varying from 0.5 per cent to 7.6 per cent.

The railway company owns a total of 150 passenger cars, the weights and motor capacities of which are recorded in Table I. A total of 104 cars are operated during the rush hours and during this period as many of the large cars are kept in operation as is possible consistent with carrying out the necessary inspection and repair work on the equipment. The average schedule speed on the entire system is 9.3 m.p.h.

TABLE I—CAR EQUIPMENT DES MOINES CITY RAILWAY

Number of Cars	Weight	Horsepower of Motors
40	31,800 lb.	92
9	35,000 lb.	92
6	42,000 lb.	140
30	41,000 lb.	100
45	36,000 lb.	100
20	36,000 lb.	75
Total, 150	5,409,000 lb.	14,348

Average weight of cars, 36,060 lb.
Average horsepower of motors, per car, 95.6.

For several years previous to Nov. 22, 1915, the company had been operating without a franchise. For this reason it was impossible to secure the necessary capital for extensions and improvements which should have been made in order to keep up with the growth of traffic, which was steadily increasing each year due to the development of the city. The result was that when a new franchise was granted the company in November, 1915, not only was the physical condition of the property as a whole in bad shape, but the amount of traffic which was being handled taxed the car equipment, power generating equipment and distributing system to the limit. The new franchise grant carried with it provisions which not only necessitated the rebuilding of several of the lines, but also the extension of certain lines, the building of a new line 2.2 miles in length and the addition of at least forty cars.

The generating equipment of the power station at that time consisted of one 1,000-kw., 2,300-volt, three-phase, 25-cycle turbo-generator; one 2,000-kw., 2,300-volt, three-phase, 25-cycle mixed-pressure turbo-generator, and two 1,000-kw., direct-current engine-driven generators. Approximately 80 per cent of the power for the system was supplied by the direct-current generators at the power station, the balance being supplied from the substations indicated in Fig. 1 as substations No. 1 and No. 2. These were supplied with three-phase, 25-cycle current at a potential of 23,000 volts from the generating station. The substation No. 2 was owned and operated by the Des Moines City Railway and in addition to supplying power for part of the city system it also supplied direct current to the south end of the Beaver Valley Division and the west end of the Flint Valley Division of the Inter-Urban Railway system. The substation No. 1 was owned by the Inter-Urban Railway and in addition to supplying power to the east end of the Flint Valley Division and the west end of the Colfax Division of the Inter-Urban system it also supplied power to the lines in the eastern part of the city.

Fig. 1 also shows the feeders leading from the power station and the two substations to the various lines, the trolley system and the return feeder system as it existed at that time, amounting to over 650,000 lb. of copper and representing an investment of $162,500, figuring the copper on an average of 25 cents per pound.

GENERATING STATION 25 PER CENT OVERLOADED—DISTRIBUTION LOSS ALSO 25 PER CENT

With the generating station carrying an overload of 25 per cent each morning and evening, the instantaneous loads reached a point which reduced the speed of the engines and turbines. The loss in the distributing system amounted to 25 per cent. It was therefore evident that in order to provide an ample supply of power for the system not only would it be necessary to increase the capacity of the generating station, but also to provide additional capacity in the feeder system. This was necessary in order to reduce the excessive line loss and to take care of the increased power demands resulting from the addition of more cars to the system, and from the speeding up of cars which would be possible providing the line potential was maintained at a fairly good value. The average schedule speed at that time was 8 m.p.h.

The problem of selecting the proper equipment for increasing the capacity of the generating station was comparatively simple. It would not have been economical from the standpoint of either first cost or operation to add additional direct-current generating capacity to the power station, as the territory covered by the lines was so great that it would have required a very heavy investment in feeder copper to distribute the additional power, with the attendant loss in the feeder. In addition to this phase of the situation, the demand of the Inter-Urban Railway for power to operate its trains and also

for commercial power was constantly increasing and for these reasons a 5,000-kw. turbine unit was installed.

In order to take advantage of the lower water rate of the 5,000-kw. turbine as compared with the other units, it was planned to install two 2,000-kw. rotary converters in the power station. In this way the entire load of both the Inter-Urban and city systems could be carried by the 5,000-kw. unit except during peak loads, the direct-current generators being operated only in case the 5,000-kw. unit was out of service. The plan for installing the two 2,000-kw. rotary converters was, however, abandoned as will be explained later on.

converter and to install additional feeder cables from this substation and the power station to the various lines. The investment necessary to increase the capacity of the substation and to cover installation of additional feeders from this station and the power station, together with the installation of two 2,000-kw. rotary converters at the power station as referred to above, amounted to $232,300. Over 40 per cent of this represented the cost of additional feeder cables. Fig. 2 shows the proposed overhead system with the additional feeder cables leading from the Beaver Valley substation and the power station. In Fig. 2 are also shown the

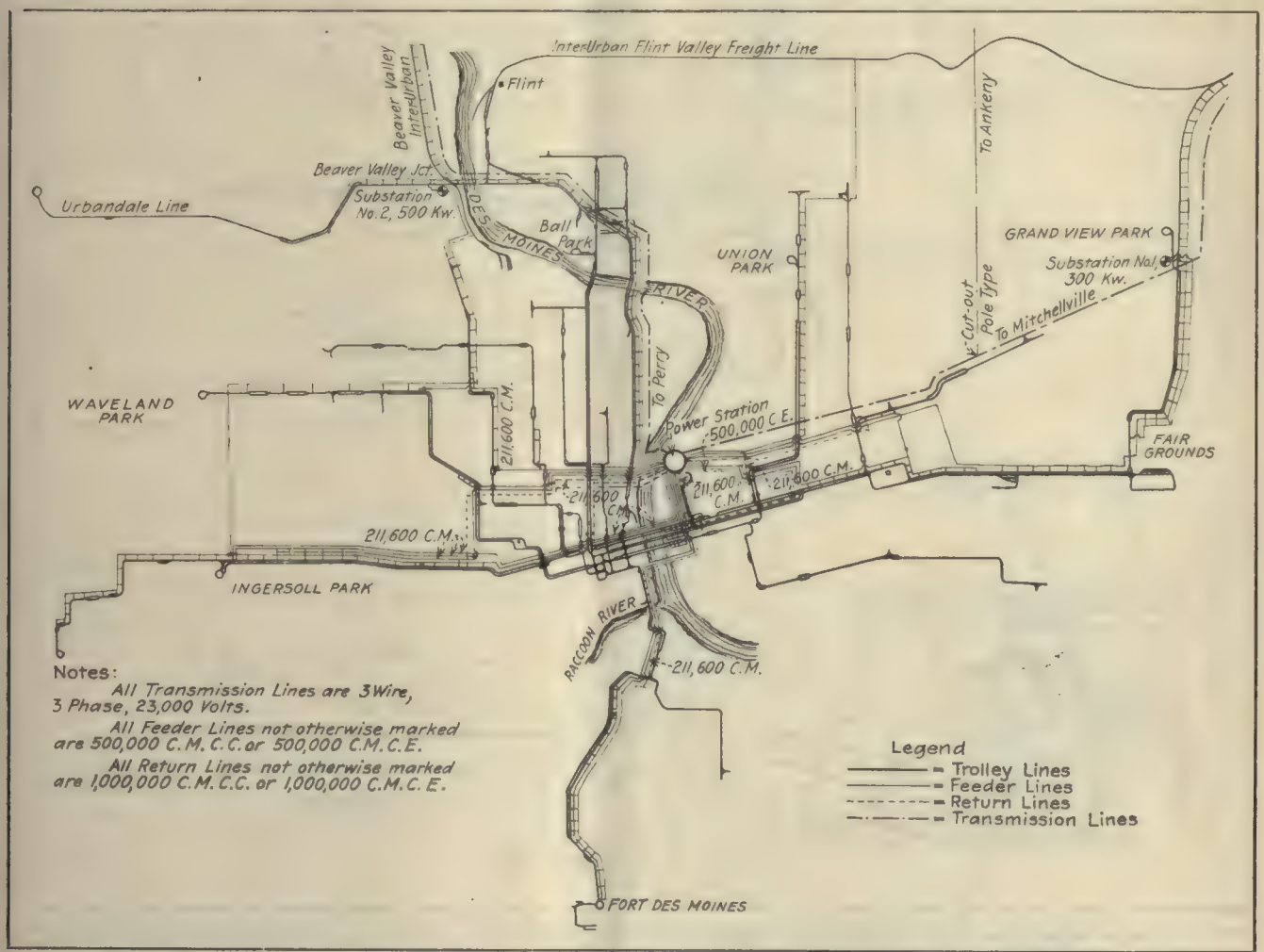


FIG. 1—TROLLEY, FEEDER AND RETURN SYSTEM OF DES MOINES CITY RAILWAY ON NOVEMBER, 1915, SHOWING ALSO THE LOCATION OF SUBSTATION NO. 1 AND SUBSTATION NO. 2. TOTAL AMOUNT OF COPPER, 650,000 LB.

The next problem was to provide an adequate distributing system. Despite the fact that there was 650,000 lb. of copper in the overhead system, representing an investment of $162,500 in copper alone, the loss in transmission was approximately 25 per cent. This represented an annual loss of $50,000. In addition to this loss in power an equal if not greater loss was being sustained due to the low schedule speeds resulting from an insufficient amount of feeder cable to maintain a good operating potential on the lines.

The first plan suggested to bring the line loss down to a point which would be considered good engineering and to provide an operating voltage which would permit of increasing the schedule speed of the cars was to increase the capacity of substation No. 1 at Beaver Valley Junction by the addition of a 1,000-kw. rotary

proposed negative feeders leading from the various lines back to the substation and power station. The total amount of copper in the system including these feeders would be 1,050,000 lb., requiring an investment of $262,500.

In order to reduce the investment in feeder cables, a second plan was considered. This contemplated the installation of two additional substations and reduced the total investment required for feeders, but when the wages of six operators, three for each substation, were capitalized, the first plan proved to be more economical.

It was evident that the second plan, with the greatly reduced amount of feeder cables and the additional substations, would be advantageous both from the standpoint of investment and of economy of operation providing the cost of attendance could be eliminated. About



FIG. 2—PROPOSED FEEDER AND NEGATIVE RETURN SYSTEM, SHOWING ADDITIONAL FEEDERS WHICH WOULD HAVE BEEN NECESSARY TO BRING LINE LOSS DOWN AND PROVIDE SUFFICIENT OPERATING VOLTAGE UNDER FIRST PLAN OF INCREASING CAPACITY OF BEAVER VALLEY STATION. TOTAL AMOUNT OF COPPER, 1,050,000 LB.

KEY TO NUMBERS IN FIG. 2

1. Insulated return to power house from Belt line, 500,000 circ.mil insulated wire.
2. Insulated return to power house from Sixth Avenue line, 300,000 circ.mil insulated.
3. Insulated return to power house from University line, 1,000,000 circ.mil insulated.
4. Insulated return to power house from Ingersoll line, 2,000,000 circ.mil insulated.
5. Insulated return to power house from Clark Street line, 500,000 circ.mil insulated.
6. Insulated return to power house from West Side loop, 750,000 circ.mil insulated.
7. Insulated return to power house from East Side loop, 1,000,000 circ.mil insulated.
8. Insulated return to power house from Fort Des Moines line, 1,000,000 circ.mil insulated.
9. Insulated return to power house from East Sixth and Ninth line, 300,000 circ.mil insulated.
10. Insulated return to power house from Capital and East Grand Division, 500,000 circ.mil insulated.
11. Insulated return to power house from East Fourteenth line, 400,000 circ.mil insulated.
12. Insulated return to Center Street line from University line, 500,000 circ.mil insulated.
13. Insulated return to Bowsher Valley substation from Center Street line, 600,000 circ.mil insulated.
14. Feeder from power house to West Ninth line, No. 0000 insulated wire.
15. Feeder from power house to Sixth Avenue line, No. 0000 insulated.
16. Feeder from power house to Clark Street line, 300,000 circ.mil insulated and No. 0000 insulated.
17. Feeder from power house to University line, 850,000 circ.mil insulated and No. 0000 insulated.
18. Feeder from power house to Valley Junction line, 500,000 circ.mil insulated.
19. Feeder from power house to Ingersoll line, 1,000,000 circ.mil insulated and 800,000 circ.mil insulated.
20. Feeder from power house to Ingersoll line, 800,000 circ.mil insulated and No. 0000 insulated.
21. Connecting feeder power house to Center Street feeder, 250,000 circ.mil insulated.
22. Feeder from power house to West Side loop, 800,000 circ.mil insulated.
23. Feeder from power house to West Side loop, 800,000 circ.mil insulated.
24. Feeder from power house to Ft. Dodge-Des Moines line, 500,000 circ.mil insulated.
25. Feeder from power house to Ft. Dodge-Des Moines line, 500,000 circ.mil insulated.
26. Feeder from power house to Sevastopol line, No. 00 insulated.
27. Feeder from power house to Scott Street line, No. 00 insulated.
28. Feeder from power house to East Side loop, No. 0000 insulated.
29. Feeder from power house to Fair Ground line, 1,000,000 insulated.
30. Feeder from power house to Douglas Avenue line and into Bowsher Valley substation, 500,000 circ.mil insulated.
31. Feeder from power house to Walker and East Fourteenth Street lines connecting with Douglas Avenue feeder, 250,000 circ.mil No. 0000 and No. 00 insulated.
32. Feeder from power house to East Sixth and Ninth line, 500,000 circ.mil insulated and No. 0000 insulated.
33. Feeder from power house to Belt line and into Bowsher Valley substation, 500,000 circ.mil insulated.
34. Feeder from Bowsher Valley substation to Urbandale line, 500,000 circ.mil insulated and No. 0000 insulated.
35. Feeder from Bowsher Valley to Center Street line, No. 0000 and No. 00 insulated.
36. Feeder from Bowsher Valley to Waveland Park line, 500,000 circ.mil insulated.
37. Connecting feeder from Bowsher Valley substation to University feeder, 800,000 circ.mil insulated.
38. Connecting feeder from Bowsher Valley substation to Clark Street feeder, 350,000 circ.mil insulated.

one year previous to this time the General Electric Company had brought out and placed in service elsewhere three automatic control equipments for rotary converter substations. An investigation of the reliability of operation of the automatic equipments was made and the result of this investigation was such that it was decided to purchase two substation equipments with automatic control. After the equipment for these two substations had been purchased, a complete survey of the traffic conditions on the lines was made and estimates of the probable increase in traffic over a period of five years were prepared. From this information the power which would be required for the different sections of the system during this period was estimated.

These figures disclosed the fact that by the installation of additional substations not only could the expense of providing additional feeder cables be eliminated, but also the greater part of the existing feeder cables of the system could be taken down and disposed of for approximately $90,000. Five additional automatically controlled equipments were purchased during the following year, and the substations were so located at different points on the system that the greatest number of the different sections could be reached with the least amount of feeder cables. Part of these equipments were delayed in delivery due to congestion in the manufacturer's plant, which was also engaged in the manufacture of apparatus for the United States government. Due also to delays in the completion of substation buildings resulting from a strike of the building trades, the last one of these equipments was not put into service until April 1, 1919.

Fig. 3 shows the location of the new substations and also of the Beaver Valley and Bowsher substations

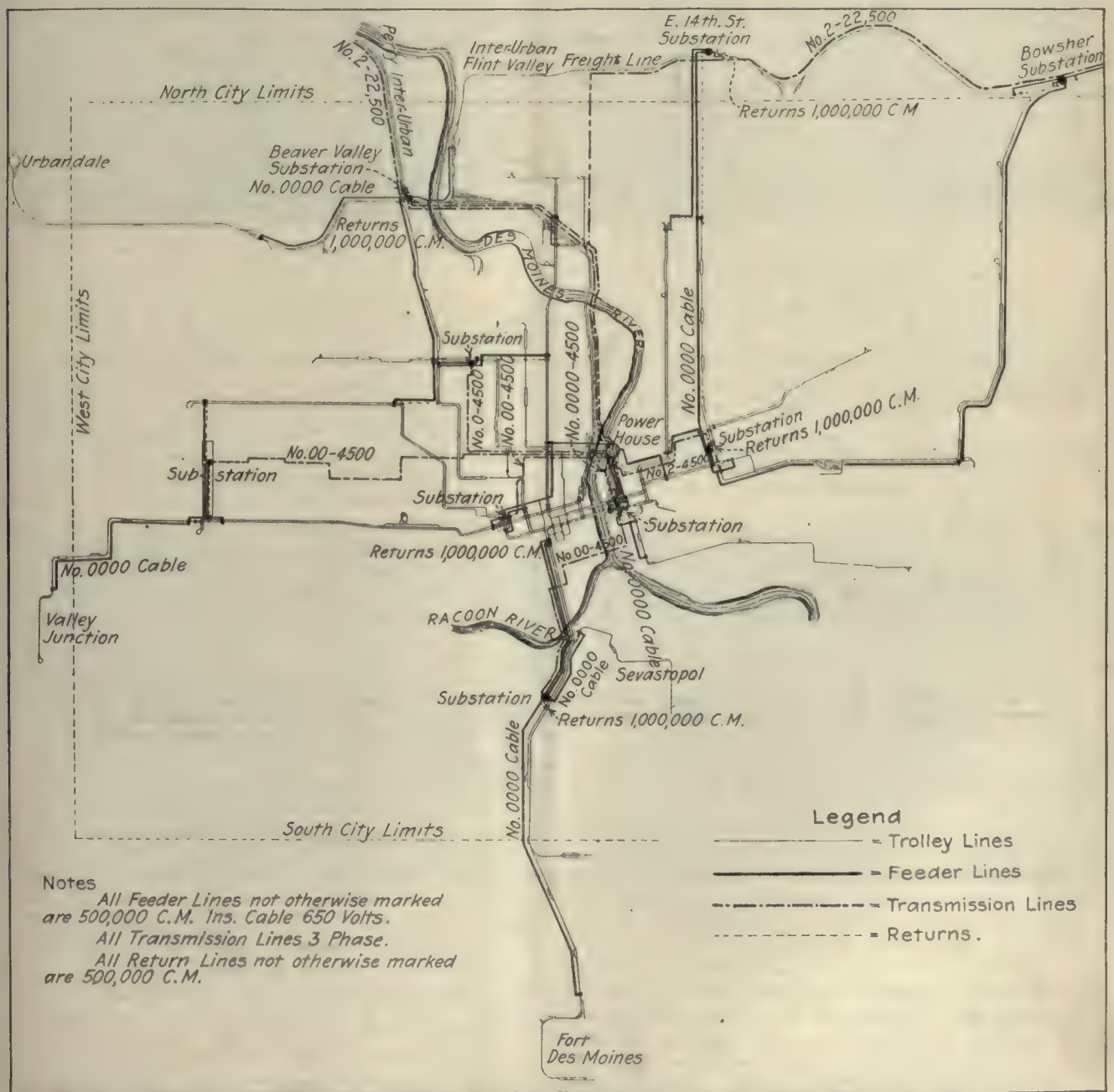


FIG. 3—OVERHEAD SYSTEM SHOWING FEEDER AND RETURN SYSTEMS AS ACTUALLY INSTALLED AND NOW IN OPERATION WITH SEVEN AUTOMATIC SUBSTATIONS. TOTAL AMOUNT OF COPPER, 460,000 LB. PRESENT TRANSMISSION LINE SYSTEM IS ALSO INDICATED

referred to above. The sections into which the trolley system is divided and the feeders leading from the substations and the power station to the different sections of the trolley system are also indicated. It will be noted that one of the stations is installed on the Flint Valley Division of the Inter-Urban system and furnishes power for both this division of the Inter-Urban line and the lines in the northern part of the city. In Fig. 3 also is shown the trolley system, location of substations and the return feeders leading from the track system to the substations and power station and the transmission lines. The total amount of copper in the system at present is 460,000 lb.



FIG. 4 EXTERIOR OF DES MOINES SINGLE-UNIT AUTOMATIC SUBSTATION



FIG. 5. EXTERIOR VIEW OF DOUBLE-UNIT AUTOMATIC STATION

Table II shows the comparative investment required for the two systems designated as A and B. System A includes the installation of rotary converters at the power station and Beaver Valley substation and additional feeders from both of these stations. System B comprises the installation of the automatic substations with transmission lines and the removal of a part of the feeder cables. The item in Table II under system B, covering equipment for changing station voltage from 2,250 to 4,500 volts and amounting to $13,322, was necessary due to the fact that with 2,250 volts the investment in copper in the transmission lines would have been enough greater to more than offset the cost of equipment for changing the station voltage.

TABLE II—COMPARISON OF COST OF TWO PROPOSED SYSTEMS TO INCREASE POWER SUPPLY AND PROVIDE ADDITIONAL FEEDER CAPACITY

	System A	System B
Power station buildings	$15,000	$5,000
Transformers, rotary converters and automatic control equipment, including miscellaneous material and installation		130,165
Transformers, rotary converters, switching equipment including miscellaneous material and installation	76,300	
Substation buildings	4,000	23,200
Transmission lines	12,000	58,183
Trolley and feeder system (copper only)	262,500	28,961
Rebuilding feeder lines	25,000	
Switching equipment for transmission lines		15,901
Equipment, miscellaneous material for changing station voltage from 2,250 to 4,500 volts		13,322
Total	$394,800	$274,732

In giving the comparative cost of the trolley and feeder system of systems A and B, the cost of pole lines, etc., has not been included, as in either case this cost would be practically the same. As the object of tabulating the costs as given in this table is to show the difference in cost of the two systems, the cost of pole lines, etc., for trolley and feeder system was omitted.

The difference in the cost of systems A and B, amounting to $120,068, is approximately $20,000 less than the difference in the cost of the two systems as estimated at the time the first two equipments were bought in 1916. This is due to the increase in cost of the equipments purchased subsequent to that date and the increase in cost of building, miscellaneous material and labor. If the seven equipments had been purchased and installed under 1916 conditions and prices, the difference in the cost of the two systems would have exceeded the original estimate of saving in the initial investment of $140,000 by at least 10 per cent.

Five of the seven automatic stations are of the single-unit type, each having a 500-kw. rotary converter, and two are designed for two units, each of 500-kw. capacity, although at the present time only one unit has been installed in each of these two stations. These stations are located at Twelfth and High Streets and East Second and Walnut Streets, which are the east and west limits of what is known as the union loop, comprising all of the tracks in the main business section of Des Moines. All cars of the system enter this loop on each round trip. As the system is extended and additional power is required the second unit will be added to each of these stations.

At the present time, in order to prevent these two stations from being too heavily overloaded during peak loads, and also to bring up the load factor on the stations in the outlying districts, the potential of the latter stations is maintained from 20 to 50 volts higher than it is at the Twelfth and High Streets and East Second and Walnut Streets stations. This difference in voltage equalizes the load between the stations. When the load has reached a point which requires the installation of the second unit in each of these two stations the voltage at all stations will be adjusted to the same value, as there will be no further necessity of guarding against excessive overloads. Due to the increased load in general on the system, all stations will then have a fairly good load factor.

FIVE SINGLE AND TWO DOUBLE-UNIT STATIONS OF SIMILAR DESIGN AND EQUIPMENT

Fig. 4 shows the exterior of one of the single-unit stations and Fig. 5 is a view of one of the stations designed for two units. These buildings, which are lo-

TABLE III—TABULATION OF RESULTS OF OPERATION OF SUBSTATIONS OVER PERIOD OF THIRTY DAYS

Station	Kw.-Hr. to Transmission Line	Kw.-Hr. Input Substations	Kw.-Hr. Output Substations	Hours Operated	Load Factor	Transmission Loss	Conversion Loss	Total Loss
Twelfth and High	119,320	115,400	104,280	261	79.91	3.29	9.70	12.66
East Second and Walnut	175,760	172,100	158,680	335	94.74	2.07	7.80	9.72
Fort Des Moines	288,880	277,000	253,180	572	88.52	4.11	8.60	12.36
East Fourteenth and Des Moines	233,140	225,200	200,880	567	70.86	3.40	10.80	13.83
Sixteenth and Clark	256,950	247,700	222,930	564	79.06	3.60	10.00	13.24
Polk Boulevard	168,270	161,900	141,660	576	49.19	3.78	12.50	15.81
Totals	1,242,320	1,199,300	1,081,610	2,875	75.25	3.46	9.81	12.94

cated in the residential sections of the city and face on streets, are constructed of face brick having struck joints. Buildings located between streets and facing on alleys are constructed of common brick, the brick in all stations being laid in cement mortar. The single unit stations are 25 ft. x 30 ft. over all with 13-in. walls and 20 ft. between the floor and underside of the concrete trusses which form a part of the roof. Each of these stations is provided with an 8-ft. x 12-ft. Kinnear rolling steel door and a 2-ft. 8-in. x 6-ft. 8-in. steel swinging door. On three sides of the building and located 14 ft. 9 in. from the floor are two 3-ft. 3-in. x 3-ft. 3-in. stationary steel sash windows of six panes each.

The double-unit type of station is 25 ft. x 40 ft. over all with the same thickness of walls and same height as the building for single units. These stations are provided with an 8-ft. x 12-ft. Kinnear rolling steel door in each end and one 2-ft. 8-in. x 6-ft. 8-in. swinging steel door. The size, location and number of windows in these stations is the same as in the single-unit stations. Ventilation for all stations is provided for by the installation of louvers at the floor line and glass top ventilators on the roof. The single unit stations have seven 2-ft. 3-in. x 2-ft. 6-in. louvers and one 3-ft. ventilator, while the two unit stations are provided with twelve 2-ft. 3-in. x 2-ft. 6-in. louvers and two 3-ft. ventilators. Figs. 6 and 7 show the interior of one of the single-unit stations.

Five of the automatic stations are supplied over aerial lines from the generating station, with three-phase, 25-cycle current at a potential of 4,500 volts, these lines entering the stations through roof bushings. One station is located in the "underground district" and the lines for this station are carried in a conduit line constructed of 3-in. fiber duct. The station which is located on the Flint Valley Division of the Inter-Urban system is supplied with current from the three-phase, 25-cycle, 22,500-volt transmission lines, which also supply current to other substations and commercial power installations along this line.

The direct-current feeders from all substations are carried underground through either iron or fiber conduit to poles located along the lines adjacent to the substations and terminate in a pothead. Lightning arresters are installed on all direct-current feeders in the substations and at the point where the cables leave the potheads. The automatic control equipment of the stations is what might be called the standard type of control as manufactured by the General Electric Company for operating this type of equipment, and as the control has been fully described in previous issues of the ELECTRIC RAILWAY JOURNAL no further description of the control equipment and the operation of same will be given at this time.

On a system equipped with automatically controlled substations when an overload or short circuit occurs on one of the trolley sections the feeder or feeders from one or more substations supplying current to this section are not disconnected from the direct-current bus at the substation by the tripping of an automatic circuit breaker, but instead a resistance of sufficient value to limit the current to a pre-determined value is inserted in series with these feeders by the opening of the line contactors. These under normal conditions form a short circuit around the resistance.

Under certain conditions, such for instance as quite an extensive break in the trolley system in congested districts or due to conflagration of a serious nature adjacent to the trolley lines, it is desirable to have some means for shutting off the current entirely from these sections without interrupting the supply of power to the other sections. Of course this could be accomplished by calling out the trouble car and having the disconnecting switches in the feeders leading to this section opened, but as some sections are supplied with current from three different substations this would require con-

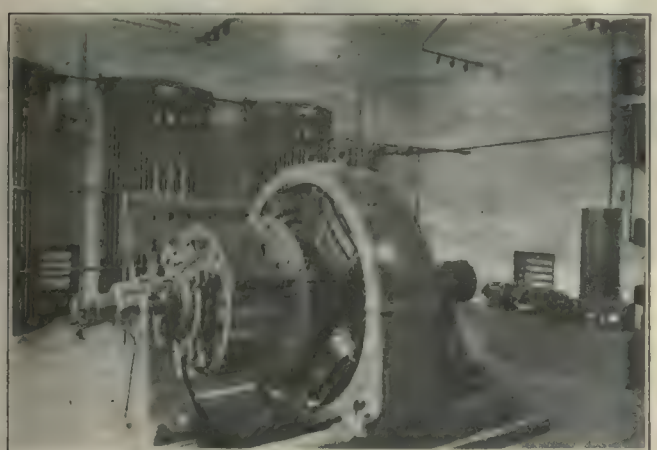


FIG. 6. INTERIOR OF SINGLE-UNIT AUTOMATIC SUBSTATION AT DES MOINES, SHOWING 500-KW. CONVERTER AND MOTOR-OPERATED CONTROLLER

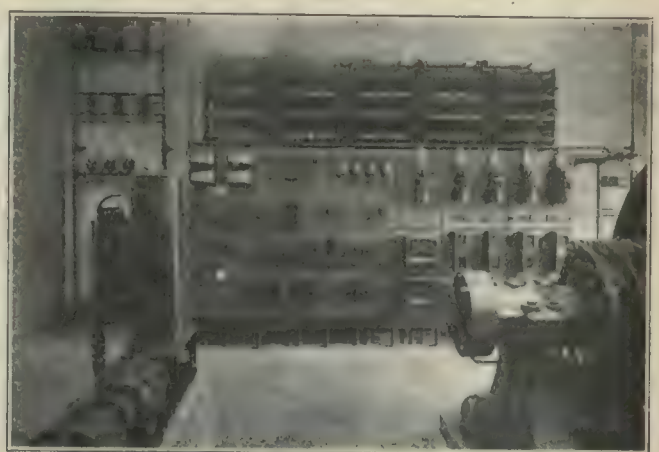


FIG. 7. SINGLE-UNIT AUTOMATIC SUBSTATION, SHOWING MOTOR-OPERATED DRUM CONTROLLER, CONTROL PANELS AND RESISTANCE

siderable time and no doubt in some cases the object of killing the line would be defeated before these switches could be opened.

To provide for emergencies of this sort and to be able to disconnect any section at any time, whether it is supplied with power from one or more substations, without delay or interruption to the supply of power to other sections, the feeders leading from each substation are connected to the bus through solenoid operated circuit breakers. These breakers are operated by means of relays located at the substations and by potential wires leading from all substations to a key board located at the power station. This is either opened or closed by the switchboard operator and any number of breakers in the feeders for a given section, whether located in one or more substations, may be operated simultaneously by turning the master key for these particular breakers in the key board located at the power station. With this equipment, the disconnecting or connecting of any section of trolley in the system, whether it is fed by one or more substations, is at all times under the control of the switchboard operator.

Table III shows the kilowatt-hours delivered to the transmission lines, the kilowatt-hours input at substations, the kilowatt-hours output at substations, the number of hours that stations were in operation, the load factor, the transmission loss, the conversion loss and the total loss over a thirty-day period.

TABLE IV—EXISTING OPERATING CONDITIONS DURING SAME THIRTY-DAY PERIOD AS TABULATED IN TABLE III.

Average peak load, kilowatts	3,234
Kilowatt capacity of rotary converters operated	3,000
Load factor (per cent)	108
Total weight of cars operated (tons)	1,826
Total horsepower of car motors	9,703
Kilowatt capacity of rotary converters operated per ton weight of cars	1 64
Kilowatt capacity of rotary converters operated per horsepower capacity of motors	0 309

Table IV shows for this period the average of the one-hour morning or evening peak load, the kilowatt capacity in rotary converters in operation, the total weight of cars (tons), the total horsepower rating of car equipment motors in operation, the ratio of capacity of rotary converters in operation to weight of equipment in operation (tons) and the ratio of capacity of rotary converters in operation to the horsepower rating of motors in operation.

The equipment of the automatic stations is inspected every two weeks. This inspection consists of a thorough examination and cleaning of all apparatus, beginning with the lightning arresters on the alternating current lines as they enter the station and following through to the terminals of the direct-current feeders. During this inspection the contacts of all relays and contactors are inspected and cleaned and if burned they are either filed or put back in good condition by the use of sand paper or emery cloth. The height of oil in the oil wells of the bearings of the rotary converters and the motor operating the control equipment is examined and also the condition of the oil rings. That is, the inspector observes the rings while the apparatus is in operation to see if oil is being fed to the bearings properly. The brushes on the alternating current and direct-current ends of the rotary converter and the brushes on the control motor are removed from the holders and the brushes and holders thoroughly cleaned and all dirt and deposit removed from commutators and collector rings. All relays having time elements are tested for time setting and also to determine if the contactors or switches in connection with which they are used function properly.

After the inspection has been completed and the apparatus is thoroughly cleaned, the station is put into operation and the operation of the control apparatus during the starting is carefully observed to make certain that all of the apparatus is left in a first-class operating condition. No additional attention is given these stations until the next regular inspection with the exception that the charging of the aluminum-cell lightning arresters is done each day during warm weather and every second day during cold weather by one of the helpers who assists in making the inspection and cleaning of the stations.

The operation and maintenance of these stations together with six similar stations and five manually operated stations on the Inter-Urban system come under the supervision of D. H. Nail. The inspection and cleaning of the automatic stations requires an average of three hours, not including the time required in going to and from the stations. One electrician and two helpers make all inspections and maintain the twelve automatic stations and also take care of the maintenance work on the five manually operated stations.

Concrete Highway Crossings for Safety

AN ARTICLE in the March issue of the *Concrete Highway Magazine* describes the use of concrete highway crossings in Wayne County, Michigan.

Three types of concrete crossing have been used. In the first, the grade is excavated 1 ft. below the bottom of the tie and is filled with concrete. Concrete is also placed between and over the ties to a level with the top of the rails, flangeways being formed in the concrete inside the railhead. In a second type the flangeway is provided by specially cut granite blocks along the inner side of the rail. This is a little more expensive than the first, but is said to have proved satisfactory.



CONCRETE HIGHWAY CROSSING AS BUILT IN MICHIGAN

A third type of crossing is built with pre-moulded concrete slabs, approximately 2 ft. x 6 ft., with a thickness equal to the depth of the rail. These slabs are cast and hardened in a construction yard and then laid like an ordinary plank crossing. An advantage in this type of construction is that the slabs can be removed, the tracks reballasted and the crossing replaced without injury to the slabs.

These concrete crossings have been constructed by the county road forces at the expense of the railroad companies and at crossings where the remainder of the highway is of concrete construction.

Future of the Electric Railway*

The Electric Railway Industry Has Suffered Greatly from Increased Costs of Operation, but Conditions Are Gradually Righting Themselves Through Fare Raises—Essential Nature of the Industry Proved—Better Labor Conditions Follow the Strike in Kansas City—Bright Future Predicted

BY PHILIP J. KEALY
President the Kansas City Railways Company

THE future of the urban electric traction is, in my opinion, based upon the generally accepted premise that urban transportation is essential, since every phase of our social and commercial life is predicated upon its existence. There is today nothing known that can take the place of electrically propelled track units. What is essential must be continued, and to be continued must be adequately supported.

Our electric railway properties in the past four years have weathered storms which an industry less essential could not have survived. It has suffered financially and physically, but I am confident that the silver lining to the dark clouds through which we have passed is just beginning to show itself. We have gained what in the future will prove to be perhaps our most valuable asset—an enlightened public opinion. The industry today stands upon the threshold of a new cycle which will insure its continuation upon a stable, self-supporting basis. The days of large profits and inefficiency are over, and rightly so. However, the new era will mean security and a reasonable return for investors, better rewards for able and efficient management, better working conditions for employees and better service for the public.

Urban transportation depends upon four elements, namely, the investor, the employee, the management and the public. Its success will be directly commensurate with the co-operation of these four essential factors. Mutuality of interest must be secured, not theoretically but practically, in order to sustain that transportation which our cities must realize for their continued growth and development.

The experience of the last four years has held no inducements for investors, but on the contrary, has been a positive deterrent. Those with money already invested have struggled against heavy odds not alone to secure interest, but to prevent the integrity of the principal itself from being further jeopardized.

SHAMEFUL TREATMENT OF RAILWAYS DURING WAR

The treatment of the street railway industry at Washington evidenced a shameful failure on the part of our national government. Calling upon the industry for the utmost to provide an absolutely essential service properly to maintain our feverish war industries, it was driven almost to the breaking point. Yet the fact remains that with this demand for service went no corresponding relief for its exigencies. The industry was in the paradoxical position of being crushed by the very force which it was working night and day to maintain. War prices, exorbitant labor demands, decreased productiveness of man power, immediate and pressing financial obligations, all offsprings of war conditions, were forcing it daily to the brink of bankruptcy. On the other hand, municipal, state and governmental authorities were demanding more and more from the industry. And let it here be said to the credit of every man connected with the business, that this demand was met patriotically and unselfishly. War-time service was given at the actual out-of-pocket expense of those who had made the industry possible. Extensions were built, equipment was purchased, wages were raised, material prices were met, at a time when the operating revenues were not paying the operating expenses. The government, through its various emergency agencies, such as the War Finance Corporation, War Industries Board, Fuel Administration and the War Labor Board, combined to fix increased expenses, but absolutely refused to adjust revenues to meet these emergency prices. With the most extraordinary powers any central government ever possessed at its command, it never used one of them to assist an industry upon whose continued operation depended all the others.

The industry, actively to function, must have at least $500,000,000 in new money annually. There is only one source from which this can come, and that is the pockets of the investors of the United States. The credit of the street railway business must be restored as a condition precedent to its continued existence. The census is showing a tremendous population increase in all of our large centers, ranging from 20 to 50 per cent. There is a certain ratio of actual annual investment needed to this population increase. Unless this money is forthcoming, the transportation systems of our cities cannot grow with their population and our plants will be inadequate to care for the civic demands made upon them.

LABOR PRESENTS INCREASED DEMANDS

The human element in the electric railway industry has presented a pressing problem in the past few years, the solution of which has in many cases not yet been found. Taking advantage of war conditions, street railway employees, aided, inspired and abetted by the activities of the Amalgamated Association of Detroit, made demands, in many cases unreasonable, and which the industry was in no shape to meet. Many companies today are in financial straits due to a wage scale imposed upon them without any consideration other than the demands of the employees by the War Labor Board or some other agency. Intoxicated by its war time successes, the Amalgamated Association is today making increased demands. For example, a contract has been presented to the United Railways of St. Louis calling for a wage scale for trainmen of 85 cents an hour. Less than six months ago the Public Service Commission of Missouri arbitrated the present wage scale and granted a top wage of 60 cents per hour and an 8 cent cash fare to make possible the payment of the scale. To meet the present demands would re-

*Abstract of paper presented at convention of Oklahoma Utilities Association, Oklahoma City, March 9, 1920.

quire approximately $84,000,000 more a year. It is doubtful if the St. Louis company or any other could stand such an increase.

I think I am correct in making the statement that the industry, prior to 1913, in the majority of cases existed and paid its interest only through the fact that its employees were generally underpaid. Labor was plentiful, and the industry presented attractions to the prospective trainman that seemingly made up for low wages. We know now that labor conditions have entirely changed, and rightly so. No industry can successfully maintain a position founded upon low wages. It is its duty and obligation to pay fair wages that will not only attract high class men but will make their living conditions comparable with those in other lines. This obligation comes ahead of interest. It is one that must be fairly and squarely met in the future, and no community has the right to expect or demand service at the expense of the men whose manual labor makes this service possible.

The human element in the electric railway business is perhaps more important than in any other industry, inasmuch as our payrolls approximate 65 to 70 per cent of our yearly expense. And the unfortunate aspect of the situation is the fact that union domination stands in the way of our securing that co-operation and mutuality of interest in the business that we should have with our employees. Aside from the physical and economic reasons that make possible the continuation of a 5-cent fare in Philadelphia, much of the success of the traction company there is due to the co-operation it has been able to secure from its men. The present policy of the Amalgamated, to obtain as much and give as little as possible, to regard the company as its natural enemy and to continue extravagant demands without taking into consideration financial conditions, is a policy, I feel, that must be materially changed.

Co-operative Committees Work Well in Kansas City

I believe that much of our work in the future lies in this direction. As operators, it devolves upon us to change this strained and unnatural condition if we are going to secure that co-operation with our employees that spells success. You will pardon me in this connection if I dwell briefly upon our experiences in Kansas City. I believe today we have there the most favorable labor situation the company has ever enjoyed. It has been secured at the expense of a strike which cost the company more than $1,000,000. Under the leadership of the Amalgamated our men struck three times within a period of eighteen months, on two of which occasions they violated solemn contracts. Due to this union domination discipline was lax and we had anything but a co-operative spirit on the property. On several occasions our employees were instructed by their union leaders not to appear at division meetings called by the officials of the company to discuss matters of operation. Today we have practically an entirely new organization.

With this organization of men not affiliated with any union in any way, we immediately put into effect a new idea, which it seems to me is a large factor in preserving and maintaining proper relations with employees today. I refer to the shop committee system, which has worked so well in Philadelphia, in the Bethlehem Steel Works and in many other large institutions. It insures proper representation of employees on department committees and gives them an active participation in the affairs of the company in so far as they reflect on working conditions, discipline, etc. These committees are elected solely by the employees and represent them on any question that may arise. We have now been operating with this system for a year, and it has proven very satisfactory in every way. In spite of the fact that employees have the right of appeal to the president of the company, practically every case that has arisen has been settled with the division superintendent and the local committee at the barn. Not only does it give the employees a medium for insuring fairness in discipline matters, but it has a tendency to make subordinate officials play the game fairly, with the result that there is a closer degree of contact and better harmony at the very point where trouble formerly originated—that is, where the management directly comes into contact with the employees through subordinate officials.

During the year a number of matters have arisen on which we desired the advice and co-operation of the employees; for example, questions affecting seniority; changes in uniform; changing the method of payment from cash to check, and other matters. When these arose, the employees' committees were called in and the matter explained, and they were then asked to put the various questions up to the men. These committee meetings are also prolific of suggestions, many of which are of much value. They have a tendency to correct minor grievances at the source.

In connection with the work of these committees, we make it a point through the meetings with the committees and the men, and through our employees' publication, to keep the employees well acquainted with the financial condition of the company and its monthly statement in an effort to secure their interest and co-operation.

We also have a local Brotherhood on the property, which has a membership of approximately 2,300. This provides a $15 sick and accident benefit; seven days per month free medical attendance, and a $300 death benefit. The dues are $1.75 per month, in addition to which the company donates 50 cents per month per member.

We have cut out the so-called welfare work as it has been understood in the past. Our employees want their shower baths in their pay envelopes. They have never appreciated welfare activities when given in lieu of wages. I do not mean by this that it is not a solemn obligation of every employer to do everything possible to improve the physical, mental and spiritual side of his employees, but it can be done without handing the agencies for this improvement to them upon a silver platter. Interest the men so that they will provide their own welfare work. When they have done this they will appreciate it. It is something they are doing themselves through co-operative effort, and not presented to them by the company. The company can, of course, in connection with this render financial assistance, but only predicated upon the fact that the men themselves meet it half way in the work. Teach employees the benefits of co-operative activities for their own good will, but at the same time teach them the necessity of co-operating with the management in bringing success to the company.

Although it is still early to count our chickens, yet we believe these methods consistently followed will bring about a feeling of co-operation and mutuality of interest that we have never before enjoyed in our organization. If this is done, a very solid foundation will have been laid for the future progress of the Kansas City Railways. The enthusiastic, whole-hearted support of 4,000 employees is a powerful force in any community, however large.

New Problems Are Being Solved

From the standpoint of management many new problems have in the past year or two presented themselves, and many more will arise in the future. The day of inefficiency is over. In order to insure a fair return to our investors, good wages to our employees, and proper service to the public, it will require much more exacting application to the finer problems of operation than was necessary in the past.

The day of exploitation with its evils of overcapitalization and lax methods in management is past, and I believe the long train of evil results has worn itself out. The public has taken this matter in hand and through its various governmental agencies has forced square dealing where it was not given willingly. The old bugaboo of watered stock and financial mismanagement is practically out of the public mind, and to some extent the slate has been wiped clean, which in itself augurs well for the future of the industry.

And last, but not least, comes the public, which it is our obligation to serve, and without the co-operation of which we cannot obtain the maximum result. I know that great progress has been made in the past three years. In fact, from the first application for a fare increase there has been a constant campaign of education which has brought the street railway industry more clearly into the public mind. I feel that the necessities for fare increases are now known to practically every one. Furthermore, when the public can feel that the management has been efficient, that a fair valuation has been placed upon a property, and that good service is being maintained, there is little opposition to necessary fare increases. There was of course at first a violent reaction, fostered and supported by antagonistic newspapers and publicity-seeking politicians. This was evidenced by the fact that in practically every city fare increases were followed by a decrease in riding. Thus the Boston Elevated, after raising fares, was barely able for six months to meet its operating expenses. Now, with a 10-cent fare, it has not only been earning its interest, but making enough to wipe out a staggering deficit. The same has been true in Chicago, Cleveland and many other cities, and is also, although more slowly, the case in Kansas City.

These facts refute the stock argument of the politician and the antagonistic newspaper made some time ago that higher fares resulted in decreased riding to the extent that no benefits could result. This has been proved untrue in not only the street railway industry, but in all others. For example, newspapers formerly sold for a cent and now are selling at two, and selling more than they ever did. Automobiles have increased in price from 20 to 100 per cent and more are being produced than ever before. In every other line this is true. The street railway business perhaps suffered most in this respect from the peculiar psychological effect of a fare increase upon the public. Much of this of course was due to the antagonism of politicians and newspapers. Much more, however, can be attributed to the fact that the increased fare was impressed upon the public twice daily. In the case of electric and gas companies where the bill was paid once a month this was not true, and there has been practically no opposition to increased electric and gas rates throughout the country. If the public paid its car fare monthly, even a 10-cent fare would probably result in increased riding just as price increases have resulted in increased business in all other lines.

It now seems, however, that the public no longer connects a street car ride with 5 cents. The cost-of-service plan is more or less firmly fixed in the public mind, and in this step alone we have made a tremendous advance, for any industry that must sell its only output at a fixed price irrespective of its production cost is basically unsound and unstable. Unless that condition change, the industry must fail. There is no more relation between the price of car fare in Oklahoma City, Kansas City and New York City than of milk and eggs in the same communities.

Furthermore, there is an indication of a more direct public co-operation in other ways. Governing bodies and even antagonistic newspapers are beginning to see that if urban transportation in congested centers is to continue adequate for a city's needs every possible help must be extended.

Brighter Future Is Ahead

I am confident that we are today standing on the threshold of a brighter future for our industry. There are many other evidences of this than those outlined above. After all, our experience teaches us that the pendulum is constantly swinging and action is always followed by reaction. Perhaps for the first time in the last three or four years we have reached a somewhat settled state and are in a position really to operate our properties. We have adjusted fares. The labor situation is settling itself to some extent, and we have to deal with a more complacent and better educated public. The country has partially adjusted itself from the shock of wartime conditions, and on every hand we see evidences that it is the desire of business and labor to settle down and once more go to work. It looks as if the peak of high-price era has been reached, and from now on we may look for declining prices. Europe is again producing, and with a world once more at work, we may confidently look forward in the very near future to a readjustment approximating normal conditions and a resetting of a world thrown out of joint by the catastrophe of a war, a contingency never dreamed of.

The labor problem, it seems, is settling itself. The necessity for production and for an honest day's work for an honest day's pay is becoming impressed upon all classes. Labor is beginning to realize its vital part in the readjustment of the world's affairs.

We have had to fight our own battles without assistance. We have had to take our case to the public and to those governmental agencies that in many instances have not functioned until the very existence of the service upon which our cities depend was threatened. It does look, however, as if our efforts are to be successful and that a stable future is to be assured the street railway business. As stated before, these things have come about not only through the sacrifices

and efforts that have been made, but from the outstanding economic fact that as street railway service is absolutely essential to the well being of our cities, what is essential in our civilization must be continued, and what must continue must be adequately supported. The price of service must meet its cost, and for the first time since its inception the industry is getting itself upon a strictly business basis, where its product must be sold for what it cost, plus a fair and reasonable return to those who invested their money to make possible an essential public service.

N. F. P. A. Approves Code Revisions

FOLLOWING the public hearing held in New York City on March 28, the electrical committee of the National Fire Protection Association approved without material change the recommendations of the committee on cars and railways. This committee consists of Martin Schreiber, chairman; R. C. Bird and Ralph Sweetland. The following abstract covers the part of the report of the committee which was approved substantially as given:

NEW CARHOUSE WIRING RULES

The revision of the rules for carhouse wiring, as recommended below, was developed in co-operation with a committee appointed by the A. E. R. E. A. It has been approved by the standards committee of the A. E. R. E. A. as recommended practice and was ratified by the American Electric Railway Engineering Association on Oct. 8, 1919, at its annual convention at Atlantic City. Your committee, therefore, submits these carhouse wiring rules for the approval of the electrical committee and recommends them to be substituted for Rule 41.

COMMITTEE'S COMMENTS ON REVISIONS IN RULE 41

In revising these rules it was our thought to preserve as far as possible the intent of the old N. E. C. rules, but to put them in a form that would meet the wishes of the various parties interested.

(a) Trolley Wires—Intended to cover installations of 1,200 volts and over.

Paragraph 2 is new.

(b) Cutout Switches and Line Breakers — Railway engineers were unanimously opposed to binding themselves to any definite distance for line insulators such as 100 ft or 50 ft. To cut the wires dead on surrounding streets is all that underwriters need ask for, and usually this can be accomplished by a 50 ft. distance. In some cities with narrow streets insulators must be placed less than 50 ft. from building.

Paragraphs 3 and 4 are new.

(c) New paragraph.

(f) New paragraph.

(h) Voltage raised to 750. Many companies carry 750 volts on their switchboards. This means that at times of no load voltage may go as high as 750.

(i) New paragraph.

THE RULE SUBSTANTIALLY AS IT NOW STANDS

41. Carhouses.

(a) Trolley Wires.

The trolley wires must be securely supported on suitable insulating hangers, designed for the voltage used, and must be placed at such a distance apart that the distance between any two hangers is less than the distance from the trolley wire to the floor or rail.

Wood troughing or sufficient protection to prevent trolley pole forming a contact with any metal part of building shall be provided.

(b) Cutout Switch and Line Breakers.

Must have an emergency cutout switch in an accessible location outside of the building so that all trolley wires in the building may be cut out at one point. Line insulators must be installed, so that when emergency switch is open, the trolley wire leading into the building will be dead at all points, preferably within 50 ft. of the building. In carhouses not used as operating stations, the current must be cut out of the building when not needed for use in the building.

In the feed to the carhouse is underground the emergency switch may be installed inside the building, but must be located at a point as near as practicable to where the underground feeder enters the building.

When carhouse or yard is divided into fire sections, auxiliary cutout switches shall be arranged to control each section independently and may be located inside of building near track entrance.

Trolley wires in car storage yards, or distinctive sections of a large storage yard, shall be controlled by an emergency cutout switch as described above. Yards in conjunction with carhouses shall be treated as a separate section and have auxiliary cutout switch.

(c) Approved lighting arresters shall be installed adequately to protect all overhead trolley wires in carhouses and car storage yards inside of the line insulators (breakers).

(d) Current collectors shall be removed from contact with trolley wire while cars are not in use. Suitable signs posted in conspicuous places are recommended.

(e) Must have all rails bonded at each joint with a conductor having a carrying capacity at least equivalent to No. 0 B. & S. gage annealed copper wire, and all rails must be connected to the outside ground return circuit by a not less than No. 0 B. & S. gage copper wire, or by equivalent bonding through the track.

(f) Power third rails shall be rigidly supported on suitable insulating supports and properly bonded at joints.

Power rails within each fire section of building or storage yards shall be controlled by an emergency cutout switch located in a readily accessible place outside of building.

(g) Except as hereinafter provided in Section h, all wiring and apparatus shall be installed in accordance with approved practice for constant potential systems.

(h) All lamps and stationary motors must be installed in such a way that one main switch may control the whole of each installation, lighting and power, independently of the main cutout switch called for in Section B.

When current for lighting, stationary motors, heating, testing apparatus, etc., is from a grounded trolley circuit, the following special rules to apply:

(1) Voltage from light, heat or power shall not exceed 750 volts.

(2) Approved cutouts and switches must be placed in the non-grounded side of lights and motors they are to protect. Light circuits must not exceed 2,000 watts, dependent upon a single cutout.

(3) Drops to lights shall be flexible rubber covered wire or packing house cable.

(4) In series systems sockets shall be of the keyless type and of a voltage rating for the current used.

(5) Electric heaters to be of standard type.

(6) The main ground, or return wire, shall connect with the rails or negative feeder at not less than two places, and shall be protected against mechanical injury.

(7) All cutouts and switches in grounded systems should be installed in cabinets of non-conducting material. Wooden cabinets shall be lined with ¼ in. fire-resisting insulating material and painted with a non-conducting paint.

(8) All light and power wiring where subject to mechanical injury shall be installed in metal conduit.

(i) All portable testing, lighting and power devices shall be constructed of standard materials, and to withstand hard usage. All pendant cords and portable conductors will be considered as subject to hard usage.

(j) Controlling devices and apparatus for feeder distributing systems for outside distribution must be installed in a fire resisting room or compartment.

Compensation for Engineers

IN a paper on classification and compensation of engineers, read at the Chicago meeting of the American Association of Engineers on March 15, A. S. Tuttle described the investigation made on this subject under the auspices of the Engineering Council. After outlining the duties of engineers of different grades and giving average and suggested salaries for engineers in the employ of municipalities and states, the speaker said, in part:

From the latest statistics available it seems probable that the cost of living is about 80 per cent more than in 1915. This, however, is not to be regarded as the basis for the recommendations of the committee, which are intended to insure to the young unmarried man an income sufficient on which to live, and to provide compensation for men in the higher grades sufficient not only to make up the increased cost of necessaries but also designed to provide for recognition of value not heretofore given. It is conceded that men drawing the major salaries should be the ones to make the sacrifices required to meet the war expense. An argument for increasing their pay in the same or greater proportion as for the men living on the lowest living wage would be fallacious if based on the decreasing value of the dollar. In this case the advance proposed is on the ground that it gives the engineer that to which he is entitled but which has heretofore been withheld.

The needs of the lower grades of service have now been met to some extent, and if the profession as a whole could unite in a movement to indorse every effort put forth to raise the compensation of chief engineers the remainder of the problem would be easy to solve. To secure permanent improvement and attract to and retain in the profession the best men, it is desirable to fix pay at entrance at a rate such as not to bring in men who are without engineering education or who have no natural leaning along engineering lines. Men admitted to the service should be denied advance unless decided merit is shown, in which case promotion should be certain and liberal. In this way standards can be raised and the mediocre men will not remain as a handicap to the progress of those more worthy. Before engineers can reach the very highest places in administrative work they must cultivate an increased breadth of view and accept more responsibility; they must give the business side of undertakings with which they are connected the same thought that they devote to the technical features.

It cannot be questioned that the long period of comparative inactivity in railroad construction and the return of the roads to their owners must be followed by a revival of enterprises of vast magnitude. The comparative freedom from governmental red tape which will now be enjoyed should open up a brilliant prospect to men in this service, and the speaker sincerely trusts that in the new era about to dawn his professional brethren who have in the past devoted themselves to this branch of engineering will realize their long deferred hopes for the day when members of this profession will find a proper financial reward for their services.

Zone Fares Successful in Holyoke

Based on 2-Mile Zones at 3 Cents Per Mile with 6 Cents Per Zone and No Reduced Rate Tickets—Conductors Make Hand Collections Zone by Zone with Overhead Registration—Transfers Unknown

THE zone system in effect since Nov. 9, 1919, on the lines of the Holyoke (Mass.) Street Railway is a model for simplicity, in that the rate of fare in each zone is uniform, free transfers are abolished except at one point in the suburban territory and reduced rate tickets—except those required by law for school children—are unknown.

The result is that the system has proved satisfactory to the company in that it is giving sufficient revenues to meet the cost of service, although it has reduced the fare for the majority of car riders within the city of Holyoke itself, where by far the greater number of people ride. The conductors find the system of collection can be handled rapidly inasmuch as the difficulties of variable fares do not exist, no matter how heavy the traffic.



GATEWAY TO THE CITY OF HOLYOKE

The Holyoke Street Railway is not a city system entirely. It operates about 57 miles of lines radiating from what might be termed the hub of the system, Holyoke City Hall, and serves a population of approximately 120,000, one-half of which is within the borders of the city of Holyoke.

The accompanying map shows the track layout of the system and the length and location of each fare zone.

In general the average length of the twenty-eight zones on the various routes is 2 miles. This with a minimum zone fare of 6 cents gives a theoretical rate of 3 cents per mile. The area included within the first zone from City Hall, as shown on the map, includes practically all of the business district as well as the built up residential section of the city. This zone limit is in several cases at the actual borders of the city, although in laying out the system the plan of following the city boundaries was not the basis used, but instead the limit was placed so as to take care of the greatest number of patrons within certain fixed distances from the center of the fare structure.

This plan gives a symmetry of zones with an average in the city of Holyoke of 1.97 miles, and 2.16 miles in the suburban territory for what is known as the Holyoke division, comprising 63.8 per cent of the total mileage. In the Amherst and Sunderland division, which has 18.84 miles of line, the eleven zones average 2.04 each.

The table on page 750 gives the actual length of each zone.

Cash Fares: The regular rate of fare in any zone shown on the map is 6 cents cash. When accompanied by an adult, one child under five years is carried free, providing, however, such child does not occupy a seat required for a paying passenger. Any other child must pay the regular fare.

Transfers: No transfers are issued to connecting routes in any zone except the one which includes the center of the town of Amherst, namely, "N." In this case free transfers are issued to enable passengers to change from the Amherst-Sunderland route to the Orient Springs route and *vice versa* without paying two single zone fares.

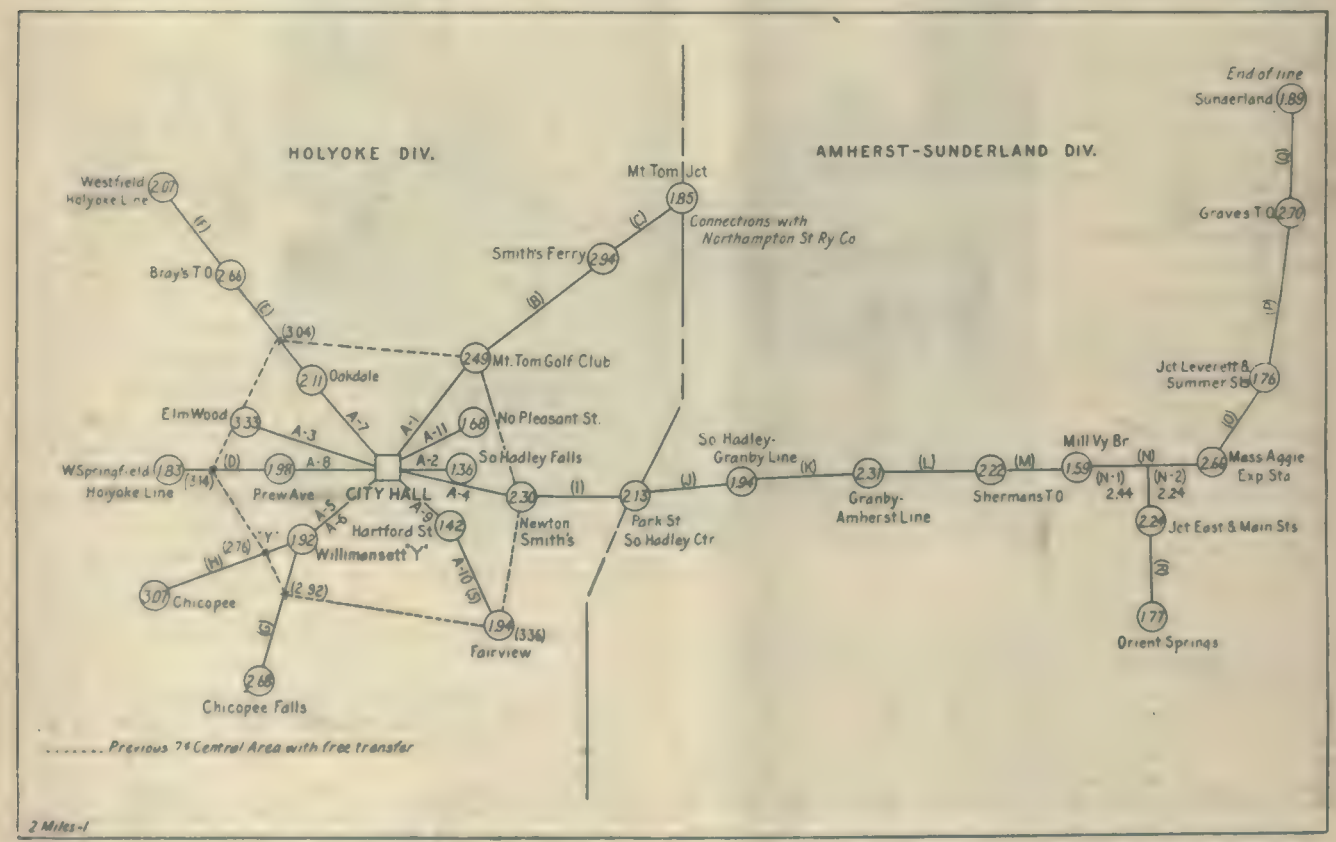
Ticket Fares: The only reduced rate tickets sold by the company are to school children inasmuch as all electric railway companies in the State of Massachusetts are required to sell such tickets at one-half the regular fare. Coupon tickets are sold in strips of ten for 30 cents at the offices of the company in Holyoke and South Amherst, each coupon of which is good for a single zone ride. Pupils, however, when purchasing such tickets must present a certificate duly signed by the school teacher verifying the signature of the pupil. This certificate becomes the property of the railway company whenever presented for the purchase of tickets. Such tickets are not valid for passage until countersigned by the pupil at the time of purchase. The name of school attended is also stamped in the ticket contract.

Full fare bearer tickets, in strips of five for 30 cents, are sold at the company's offices and also by all conductors when on duty. These tickets were put on sale merely as a matter of convenience to the conductor and the car rider so as to facilitate fare collections and at the same time reduce to a minimum the necessity of making change for a multiple coin fare. These tickets entitle users to the same privileges as the cash fare and

have proved popular. Two months after they were put on sale approximately 10 per cent of the daily transportation revenue was derived from the use of these tickets. This percentage is constantly increasing and the company anticipates that during the summer months a far greater proportion of its riders will buy these tickets.

Free transportation is furnished all employees. The same form, however, is not universally used. Permanent employes receive an annual card pass which is good for transportation on any car during the calendar year; temporary employees such as call men in the transportation department, or employees who are regularly employed during certain seasons of the year such as in the company's parks during the summer, receive a sixty-zone monthly card pass, which the conductor punches in every zone, at the time it is presented for fare. The color of this sixty-zone ride card pass is changed each month. A trip pass is also available for issuance to employees not in the service long enough to get a monthly pass. This latter from of ticket must, however, be filled in and punched as required before it will be accepted for transportation.

Special Cash Fares have been established on tripper cars in both the A.M. and P.M. rush hours in certain cases to avoid the issuance of so-called workingmen's or reduced rate tickets. The controlling factor in all such cases is that either the factory or the community settlement is located in the middle of a zone and unless such fares were established passengers would pay in reality



MAP AND KEY SHOWING ARRANGEMENT AND LENGTHS OF ZONES

HOLYOKE DIVISION

Zone Number	Between Points Applying	Route	Length (Miles)
A-1	City Hall and Highlands (Mount Tom Golf Club)	Northampton	2.49
*A-2	City Hall and North Main Street, South Hadley Falls	South Hadley Falls	1.36
A-3	City Hall and Elmwood	Elmwood	2.33
A-4	City Hall and Newton Smith's (Granby Road)	South Hadley Center	2.42
A-5	City Hall and Willimansett "Y"	Chicopee	1.92
A-6	City Hall and Willimansett "Y"	Chicopee Falls	1.92
A-7	City Hall and Oakdale (Hillside Avenue and Cherry Street)	Westfield	2.11
A-8	City Hall and Prew Avenue	Springfield	1.98
A-9	City Hall and Hartford Street	Fairview	1.42
†A-10	Hartford Street and Fairview	Fairview	1.94
A-11	City Hall and North Pleasant Street	North Pleasant Street	1.68
B	Mount Tom Golf Club and Smith's Ferry	Northampton	2.94
C	Smith's Ferry and Mount Tom Junction	Northampton	1.85
D	Prew Avenue and West Springfield-Holyoke Line	Springfield	1.83
E	Hillside Avenue and Cherry St. and Bray's Turn-Out	Westfield	2.66
F	Bray's Turn-Out and Holyoke-Westfield Line	Westfield	2.07
G	Willimansett "Y" and Chicopee Falls	Chicopee Falls	2.68
H	Willimansett "Y" and Chicopee	Chicopee	3.07
I	Newton Smith's and Park Street	South Hadley Center	2.13

*End of Line †Otherwise known as Zone 8.

Average length of nine Holyoke city zones 1.97 miles
Average length of nine suburban zones 2.35 miles
Average length of 18 zones — Holyoke Division 2.16 miles

AMHERST AND SUNDERLAND DIVISION

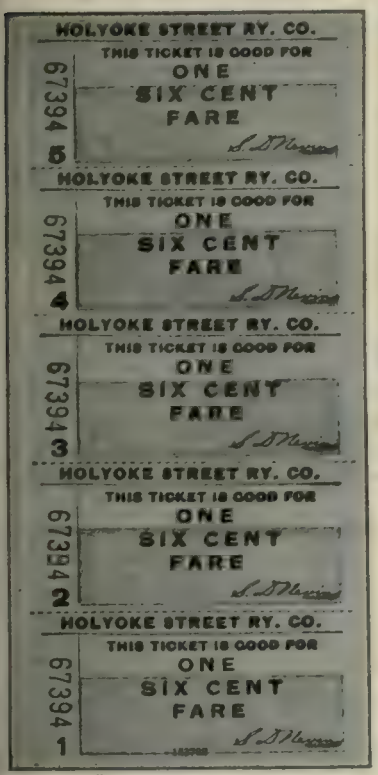
Zone Number	Between Points Applying	Route	Length (Miles)
J	Park Street, South Hadley Center and South Hadley-Granby Line	Amherst	1.94
K	South Hadley-Granby Line and Granby-Amherst Line	Amherst	2.31
L	Granby-Amherst Line and Sherman's Turn-out	Amherst	2.22
M	Sherman's Turn-out and Mill Valley Bridge	Amherst	1.59
N	Mill Valley Bridge and Massachusetts Agricultare Experimantal Station	Amherst.	2.66
N-1	or Junction of East and Main Streets	Pelham.	2.44
N-2	Junction East and Main Streets, and Massachusetts Agriculture Experimental Station	Amherst-Sunderland.	2.24
O	Massachusetts Agriculture Experimental Station and Junction of Leverett and Summer Streets	Amherst-Sunderland.	1.76
P	Junction Leverett and Summer Streets, and Graves Turn-out	Amherst-Sunderland.	2.70
Q	Graves Turn-out and end of line	Sunderland.	1.89
R	Junction East and Main Streets, Amherst and end of line, Orient Springs	Pelham.	1.77

Average length of eleven zones 2.04 miles
Average length of twenty-nine zones — entire system, 2.12 miles

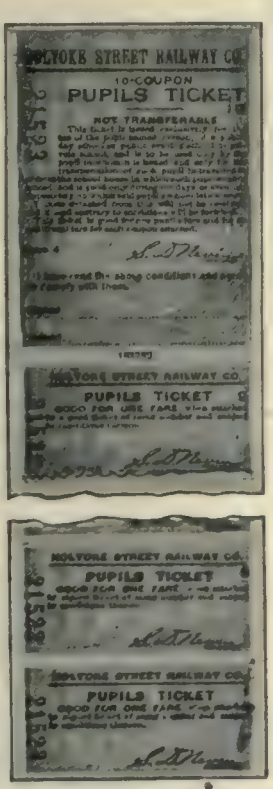
an extra zone fare for which they received nothing in return. Such service of this character as is operated, together with the fare charged and the full fare on regular cars, is shown in the following table:

SPECIAL FARES ON THROUGH TRIPPER SERVICE AND COMPARATIVE FARE ON THROUGH CARS

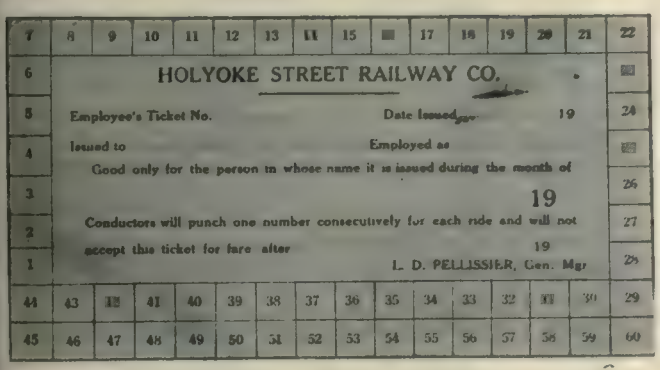
	Distance (Miles)	Hours	Fare on Trippers (Cents)	Regular Fare (Cents)	Zones
From Fairview to Chicopee Falls	5.72	5:45 — 6:30 a. m.	18	24	4
From Chicopee Falls to Fairview	5.72	5:00 — 5:30 p. m.	18	24	4
From Fairview to Williamansett Bridge	5.01	5:45 — 6:30 a. m.	12	18	3
From Willimansett Bridge to Fairview	5.01	5:00 — 6:00 p. m.	12	18	3
From Fairview to Berkshire Street	4.14	6:00 — 7:00 a. m.	12	18	3
From Berkshire Street to Fairview	4.14	5:00 — 5:30 p. m.	12	18	3



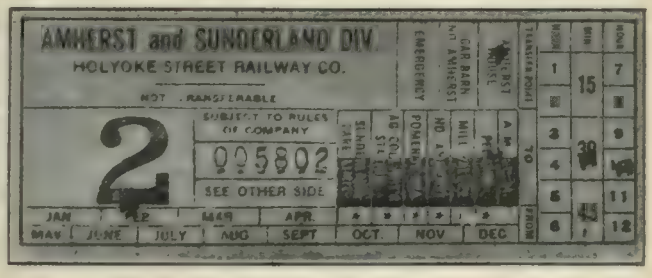
1



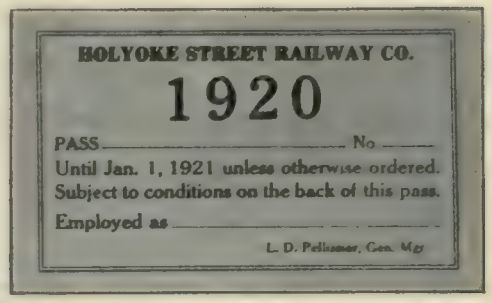
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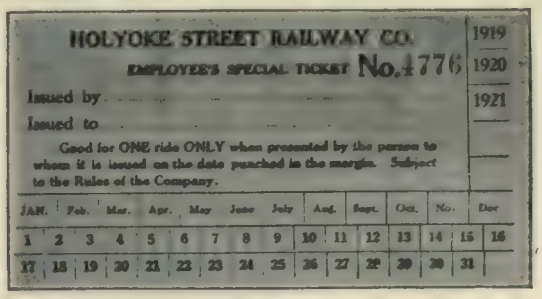
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4



5



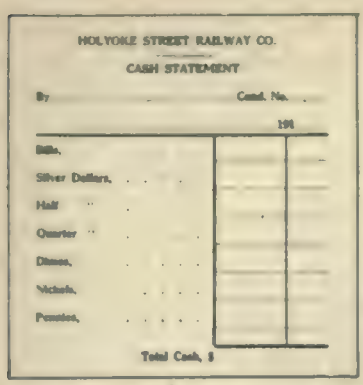
6

1. STRIP OF FIVE TICKETS SOLD FOR 30 CENTS
2. PUPILS' TICKETS
3. MONTHLY PASS
4. AMHERST TRANSFER
5. ANNUAL PASS
6. EMPLOYEES' SPECIAL TICKET

All closed and open cars are equipped with a single overhead register. In general, all cash and ticket fares collected in each zone are rung up on the overhead register, which records 6 cents for each registration with the exception of the Springfield-Holyoke Limited cars, where each registration has a value of 12 cents, due to the fact that conductors collect both zone fares between the Holyoke City Hall and the West Springfield line at once. All revenue tickets are rung up on this same register. Transfers and trip passes collected are not registered, but turned in at the end of the day's run in a special envelope.

The company in its accounting keeps traffic records somewhat different from those of other companies, aiming to get the number of zone riders paying cash or ticket fares or riding on free passes. No attempt is made to get the actual number of passengers carried or the number of zones ridden by each passenger.

The form of day card in use, shown in an accompanying illustration, is designed so that the conductor can by straightforward addition get the total zone riders on each trip or run. On the face of the day card is kept a record by trips and a summary for each run. It is essential that a separate day card be kept for each run in order that the accounting department can keep comparative records for each of the several routes operated. This is particularly true where conductors during a day operate over two or more regular runs. The conductor at the time of taking his car posts in the columns in the upper left-hand corner the register


HOLYOKE STREET RAILWAY CO.

CASH STATEMENT

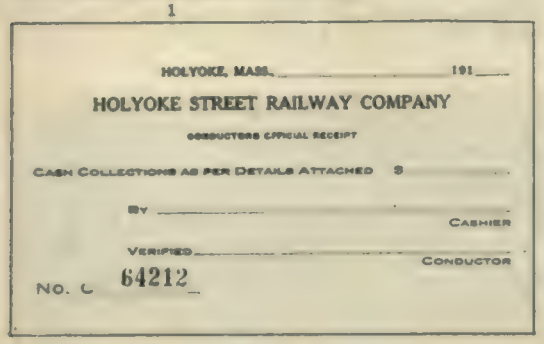
By _____ Cond. No. _____

191

Bills,
Silver Dollars,
Half "
Quarter "
Dimes,
Nickels,
Pennies,

Total Cash, $

1


HOLYOKE, MASS., _____ 191____

HOLYOKE STREET RAILWAY COMPANY

CONDUCTOR'S OFFICIAL RECEIPT

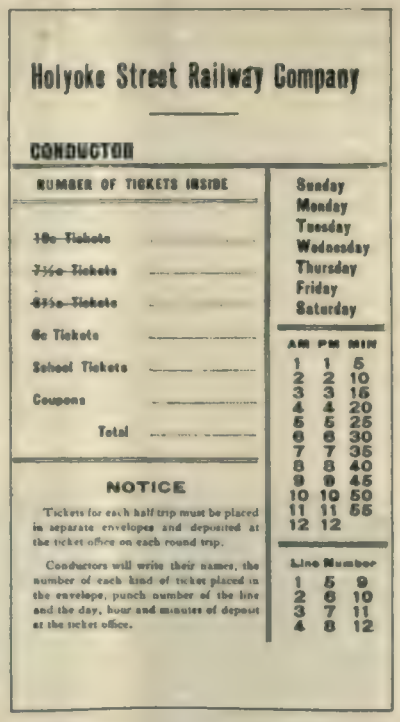
CASH COLLECTIONS AS PER DETAILS ATTACHED $ _____

BY _____ CASHIER

VERIFIED _____ CONDUCTOR

NO. C 64212

2


Holyoke Street Railway Company

CONDUCTOR

NUMBER OF TICKETS INSIDE

~~10c Tickets~~
~~7½c Tickets~~
~~8⅓c Tickets~~
6c Tickets
School Tickets
Coupons
Total

NOTICE

Tickets for each half trip must be placed in separate envelopes and deposited at the ticket office on each round trip.

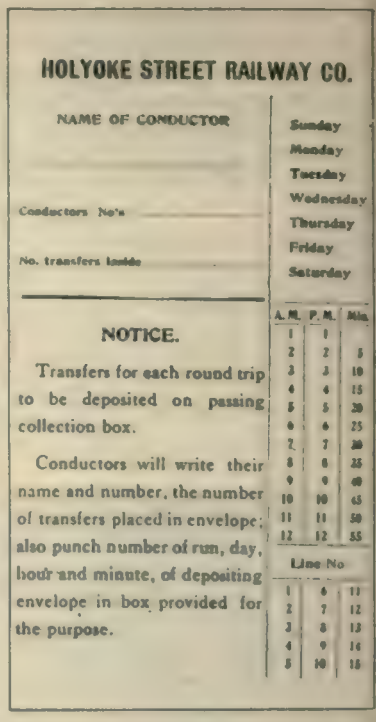
Conductors will write their names, the number of each kind of ticket placed in the envelope, punch number of the line and the day, hour and minutes of deposit at the ticket office.

Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday

AM	PM	MIN
1	1	5
2	2	10
3	3	15
4	4	20
5	5	25
6	6	30
7	7	35
8	8	40
9	9	45
10	10	50
11	11	55
12	12	

Line Number		
1	5	9
2	6	10
3	7	11
4	8	12

3


HOLYOKE STREET RAILWAY CO.

NAME OF CONDUCTOR

Conductors No's

No. transfers loaded

NOTICE.

Transfers for each round trip to be deposited on passing collection box.

Conductors will write their name and number, the number of transfers placed in envelope; also punch number of run, day, hour and minute, of depositing envelope in box provided for the purpose.

Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday

A. M.	P. M.	Min.
1	1	
2	2	5
3	3	10
4	4	15
5	5	20
6	6	25
7	7	30
8	8	35
9	9	40
10	10	45
11	11	50
12	12	55

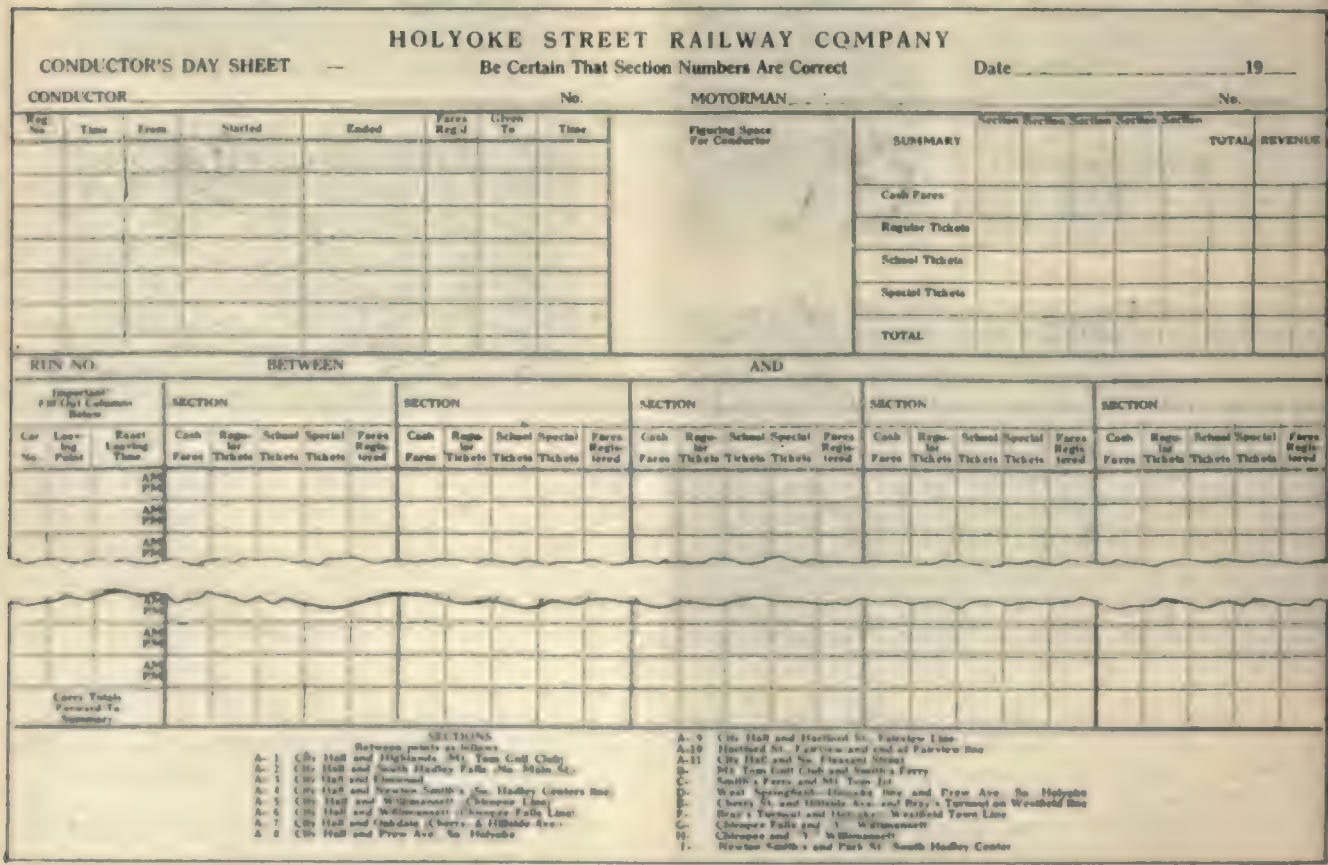
Line No		
1	6	11
2	7	12
3	8	13
4	9	14
5	10	15

4

1. CASH SLIP. 2. CONDUCTOR'S OFFICIAL RECEIPT. 3. TICKET ENVELOPE. 4. TRANSFER ENVELOPE

number, the time, and the opening number on the register totalizer and then lists the run number and points applying.

Trip figures are kept by the conductor to show collections for each fare zone. All revenue passengers, the fares of whom are registered on the car in each fare zone, are recorded in the column "Fares Registered." This reading, which is representative of the total number of cash and revenue ticket fares collected in that zone, is detailed in the respective columns to show cash fares, regular tickets, *i.e.*, full-fare tickets, school or pupils' tickets, and special tickets that are registered


HOLYOKE STREET RAILWAY COMPANY

CONDUCTOR'S DAY SHEET — Be Certain That Section Numbers Are Correct Date _____ 19____

CONDUCTOR _____ No. _____ MOTORMAN _____ No. _____

Reg No.	Time	From	Started	Ended	Fares Reg'd	Given To	Time

Figuring Space For Conductor

SUMMARY	Section	Section	Section	Section	Section	TOTAL	REVENUE
Cash Fares							
Regular Tickets							
School Tickets							
Special Tickets							
TOTAL							

RUN NO. BETWEEN AND

Important! Fill Out Columns Below			SECTION						SECTION						SECTION						SECTION						SECTION					
Car No.	Leaving Point	Exact Leaving Time	Cash Fares	Regular Tickets	School Tickets	Special Tickets	Fares Registered		Cash Fares	Regular Tickets	School Tickets	Special Tickets	Fares Registered		Cash Fares	Regular Tickets	School Tickets	Special Tickets	Fares Registered		Cash Fares	Regular Tickets	School Tickets	Special Tickets	Fares Registered		Cash Fares	Regular Tickets	School Tickets	Special Tickets	Fares Registered	
								AM PM						AM PM						AM PM						AM PM						AM PM
								AM PM						AM PM						AM PM						AM PM						AM PM
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Cars Totals Forward To Summary																																

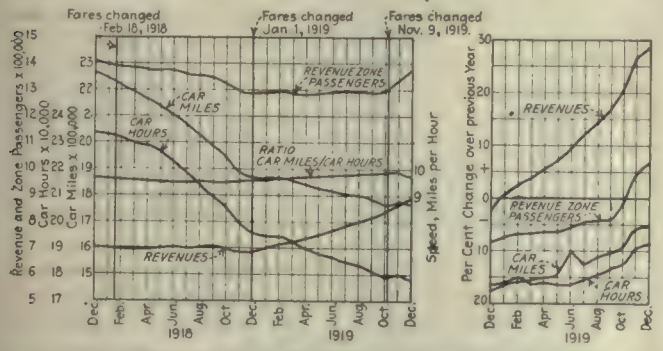
SECTIONS
Between points as follows

A- 1	City Hall and Highlands Mt. Tom Golf Club	A- 9	City Hall and Hartford St. Fairview Line
A- 2	City Hall and South Hadley Falls Mo Main St.	A-10	Hartford St. Fairview and end of Fairview line
A- 3	City Hall and Elmwood	A-11	City Hall and No Pleasant Street
A- 4	City Hall and Newton Smith's Co. Hadley Centers line	B-	Mt Tom Golf Club and Smith's Ferry
A- 5	City Hall and Willimansett Chicopee Line	C-	Smith's Ferry and Mt Tom Jct
A- 6	City Hall and Willimansett Chicopee Falls Line	D-	West Springfield Holyoke line and From Ave So Holyoke
A- 7	City Hall and Oakdale Cherry & Hillside Ave.	E-	Cherry St. and Hillside Ave. and Bray's Terminal on Westfield line
A- 8	City Hall and Prov Ave So Holyoke	F-	Bray's Terminal and Holyoke Westfield Town Line
		G-	Chicopee Falls and Willimansett
		H-	Chicopee and Willimansett
		I-	Newton Smith's and Park St South Hadley Center

DAY CARD USED BY HOLYOKE STREET RAILWAY

On completing the zone collection or on reaching the zone limit the conductor turns the register "down," and then enters the car and makes the collection for that zone. No particular trouble has been experienced due to complaints on the part of the conductors as to inability to make a collection in the time required for a car to traverse the length of a zone. Cars as a rule have a speed of approximately 12 to 15 m.p.h., and this with stops gives the conductor from eight to ten minutes to make a zone collection and post his day card.

At the end of the day the conductor totals the various columns for each fare zone and makes a summary of his work in the space provided in the upper right hand corner of the day card. He lists the cash and also converts the tickets collected into money so as to arrive at the total money equivalent for the day. Under this plan, it is possible to obtain the approximate previous day's receipts with a minimum of effort in a very short time by simply totaling the figures of the "Total Revenue" columns on conductors' day cards on an adding machine.

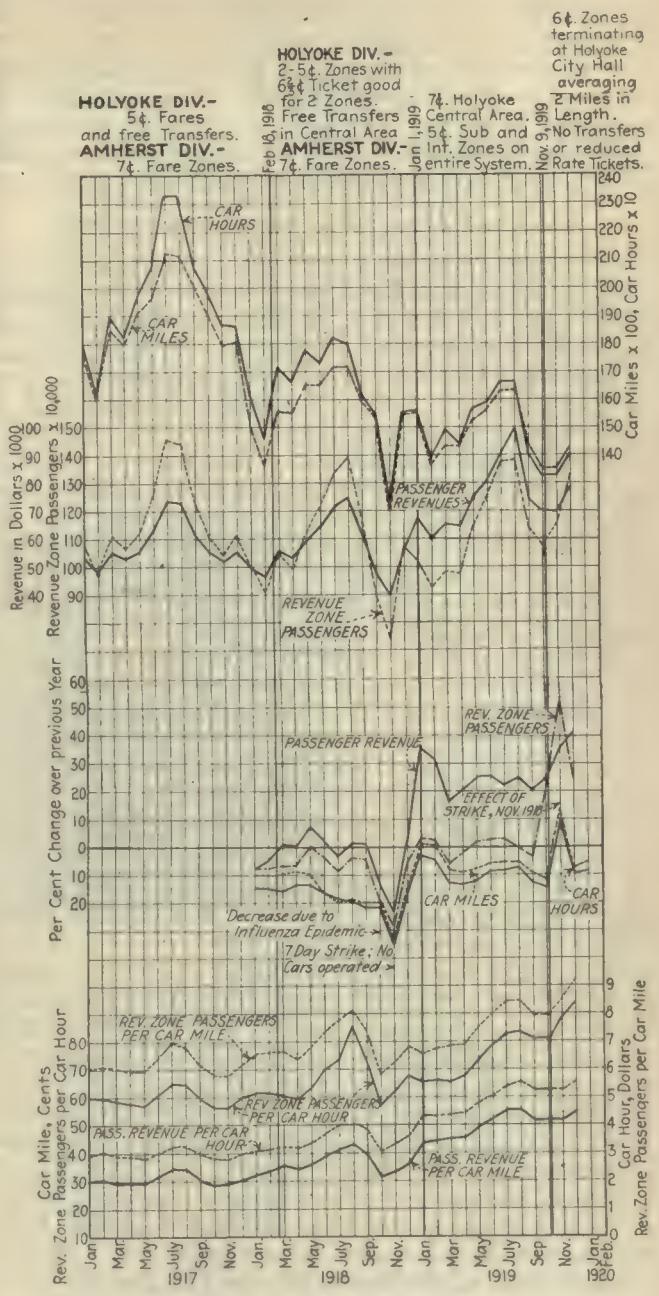


AT LEFT—TWELVE MONTHS' PROGRESSIVE TOTALS. AT RIGHT—PERCENTAGE VARIATION YEAR 1919 OVER 1918

No car register card is used, for all register readings are summarized and reconciled with fares registered and with a special register reading report which is posted each time a car leaves and enters the car house.

CONDUCTOR'S TURN-IN

On completion of a day's work all conductors make a daily turn-in to a receiver at the car house. To facilitate counting the receivers require a regular form of cash statement, showing the amount of cash in the various denominations that accompany the turn-in.



FINANCIAL RESULTS OF THE SEVERAL FARE SCHEDULES IN GRAPHICAL FORM

STATISTICS AS TO VARIOUS FARE SCHEDULES

	Year Ended Dec. 31, 1917	Feb. 18, 1918, to Dec. 31, 1918	Jan. 1, 1919, to Nov. 8, 1919	Nov. 9, 1919, to Dec. 31, 1919
Rate of fare	5-cent central area free transfers. 5-cent suburban zone.	5-cent central area free transfers. 5-cent suburban zones; 7-cent interurban zones	7-cent central area. 5-cent suburban and interurban zones	6-cent zones in former central area. 6-cent suburban and interurban zones
Length of ride for one fare, central area	Maximum 10.06	Maximum 6.67; average 2.26	Maximum 6.40; average 2.54	Maximum 2.33; average 1.97
Suburban and interurban zones	.....	Maximum 3.77; average 2.58	Maximum 2.94; average 2.07	Maximum 3.07; average 2.18
Number of zones	.....	7	18	29
Car-Mile Statistics:				
Passenger revenue (cents)	30.78	37.50	49.81	52.39
Operating revenue (cents)	30.84	37.52	51.54	54.12
Operating expenses (cents)	24 21	31.21	39.71	37.20
Revenue zone passengers	6.20	6.84	7.61	8.91
Transfer zone passengers	0.68	0.83	0.73	0.01
Total zone passengers	6.88	7.67	8.34	8.92
Car-Hour Statistics:				
Passenger revenue	$2 98	$3.56	$4 91	$5.34
Operating revenue	3.00	3.58	5.08	5.51
Operating expenses	2.34	2.98	3.90	3.76
Revenue zone passengers	59.5	65.4	75.0	90 5
Zone passengers	6 5	8 0	7.2	0.1
Total zone passengers	66 0	73.4	82.2	90 6

* Holyoke Division only.

The receiver takes the cash, checks it to the slip and makes out in duplicate a "conductor's official receipt," leaving the duplicate in a book for future auditing and reference. The conductor signs this receipt and it is attached to his day card to signify that he has turned in the day's receipts, subject to a final checking by the auditor's office for errors and omissions.

Financial Results of the Various Systems

Previous to Feb. 18, 1918, fares in the Holyoke Division were based on 5-cent units except in the Amherst and Sunderland Division, where 7 cents was the unit.

In the Holyoke Division the ride for a nickel was comparatively long in certain cases, ranging from 7.26 to 10.06 miles in twelve instances. Possible rides of more than 6 miles were frequent. On Feb. 18, 1918, zone fares were first established in the city of Holyoke at 5 cents per zone, with a reduced rate ticket at six for 40 cents (6⅔ cents) for a ride between any point in the central zone and any point in the adjacent outlying zone. This fare schedule was in effect until Dec. 31, 1918, and showed an actual loss in revenue, although if conditions surrounding the influenza epidemic in October, 1918, and the strike in November of the same year are discounted, so as to make the earnings so far as possible comparable with those of the previous year, it is believed that the theoretical increase would have been 1.2 per cent in passenger revenue. Actual increase in 1918, however, exclusive of the two months, October and November, varied from a maximum of 7.38 per cent for May to a decrease of 2.87 per cent for July. The details as to the layout of this plan were given in the ELECTRIC RAILWAY JOURNAL for Jan. 12, 1918, pages 77-80, and Sept. 14, 1918, page 458.

On Jan. 1, 1919, another scale of fares on a somewhat different basis was established. This plan had a central area including a part of the first outlying 5-cent zone, and a fare of 7 cents with free transfers in this area. In reality the minimum fare in the central area and the fare to the limit of the former first suburban or outlying zone was increased 2 cents. Suburban and interurban zones were shortened and had a fare of 5 cents. The reason for this increase was the inability of the company to secure the anticipated revenue from the system allowed by the Massachusetts Public Service Commission to become effective on Feb. 18, 1918.

This system showed a considerable greater earning power than the one superseded, as will be noted by the accompanying curves. The first month's operation showed a 35 per cent increase over the old system of fares, while for the period Jan. 1 to Aug. 1, 1919, the average increase was approximately 32.8 per cent with but little if any traffic loss. The tickets under this system, of which there were three, namely, a 10-cent ticket sold in lots of five for a 12-cent, two-zone ride at any hour of the day; a 7-cent ticket also sold in lots of five for a 10-cent, two-zone ride, during certain hours of the day; and a full-fare 7-cent ticket for use in the central zone, produced 29 per cent of the total passenger revenue. While this percentage may seem small, actual observations would indicate that in the first outlying zone nearly 75 per cent of the passengers rode on 10-cent and 7-cent reduced rate tickets.

In August, 1919, an award was given by a local board of arbitration, increasing the wages of all employees approximately 33 per cent, and inasmuch as the system of fares then in effect failed to earn sufficient revenue to pay this increase it became necessary to seek the additional revenue.

The company believed that the minimum fares should be kept as low as possible and few changes if any made in the suburban fare limits in order that the traffic loss may also be kept at a minimum. Bearing this in mind a rate structure was built up with 2-mile zones with a minimum fare of 6 cents per zone. Actual results from operation have proved that this was the correct diagnosis, for the loss in traffic has been nil and practically the theoretical increase in revenue anticipated has been actually realized.

Car-mile passenger revenues average 51.50 cents in November, 1919, as against 33.39 cents for 1918 and 29.06 cents for 1917, while car-hour earnings that averaged $2.78 in 1917 and $3.32 in 1918 have increased to $5.25 in November, 1919. Against this, operating revenues have also increased from $3 in 1917 to $5.47 in November, 1919.

The table on page 753 and accompanying diagrams show the actual monthly and periodical variations in the four different rate structures. It is to be noted that the schedule in effect on Nov. 9 last shows the best earning power of the four schedules shown—due principally to the fact that the company by keeping the minimum fare at the lowest possible point and eliminating transfers has been able to increase instead of decrease the riding habit.

Welfare Work Among Philadelphia Employees

CO-OPERATIVE welfare work is proving successful in Philadelphia, according to the last P. R. T. report. Last September the membership in the Co-operative Welfare Association had reached 99.51 per cent of the eligible employees. The company in recognition of this record doubled its contribution to the association and, effective Jan. 1, 1920, is contributing $20,000 monthly. This sum is equal to $2 for each $1 of dues paid by the members.

During the first 16 months existence, that is up to Dec. 31, 1919, the association paid $1,000 life insurance to the beneficiaries of 184 employees. Sick benefits were paid to 1645 employees at the rate of $1.50 per day, totaling $75,572.50. Pensions have been paid to ninety-nine employees at the rate of $40 per month. On Dec. 31 the total pensions being paid were at the rate of $47,520 per year.

In October, 1919, a savings fund was opened by the employees and on Dec. 27, 1919, over two-thirds of the membership had opened accounts, with an average of $10 a month to each account. Prediction is made that prior to the next annual meeting, which will be in September, 1920, 80 per cent of the members would have savings accounts and the accumulated total would be more than $1,000,000.

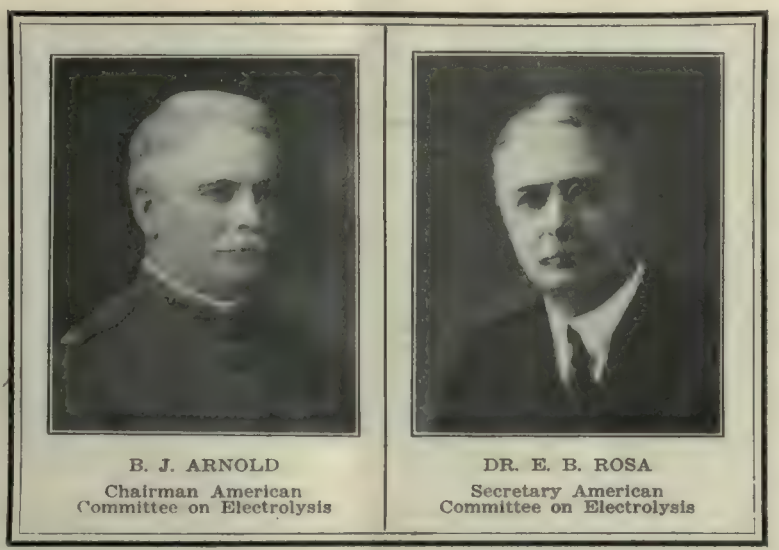
Safety Cars Cheap to Run

THE report of the Committee of One Hundred of the Kansas City (Mo.) Chamber of Commerce indicates that the thirty one-man safety cars have proven economical in operation. The total cost of operation is about 19 cents per car-mile, as compared with 32 cents for the larger cars, even though operators are paid 5 cents more than regular trainmen.

Co-operation in Electrolysis Research

Research Sub-Committee of American Committee on Electrolysis and United States Bureau of Standards Are Working Jointly in Collecting and Digesting Data

FROM time to time the ELECTRIC RAILWAY JOURNAL has discussed the work of the American committee on electrolysis and its predecessors and the researches which have been made by the United States Bureau of Standards. Now that the American committee is taking up its work again actively, with meetings of the research sub-committee held on the last Friday of each month, it is appropriate to review the whole program of research on prevention of electrolysis from stray electric currents as planned by the American committee in co-operation with the Bureau of Standards. The present article has been prepared with this idea in view.



B. J. ARNOLD
Chairman American Committee on Electrolysis

DR. E. B. ROSA
Secretary American Committee on Electrolysis

Those who were concerned with the operation of electric railways in the nineties and the early years of the present century will recall the incredulity and surprise attending the first evidences of stray-current electrolysis, and how this surprise was followed by dismay as increasing numbers of pipes were unearthed showing the ravages of unconfined currents. It was a phenomenon entirely new and unforeseen to the railway engineers as well as the pipe and cable-owning companies, and one for which no effective remedy was known. In those early days the return circuit was not given the attention that it now receives, partly because the importance of the electrolysis problem was not appreciated, partly because of the primitive state of the art of rail bonding and often because the earth was intentionally relied upon to carry the return current, on the assumption that it offered no electrical resistance.

The history of the development of rail bonding is in itself an interesting story and those who are familiar with it know that the number of types of bonds which have been used is legion. The bonded rail joint has been the weakest link in the return circuit and until the adoption of the welded joint, now commonly used in the larger cities, was responsible more than any other one thing for the extremely bad electrolysis conditions which existed in many cities. With the improvement of the return circuit through the use of heavier rails, better bonds, welded joints and supplementary feeders, railway loads also increased and often at a rate far greater than the increase in the return circuit. The result was that with the phenomenal growth of the electric railways those factors which were not vitally and immediately necessary to the operation of the cars were often slighted or entirely neglected. In not a few instances the electrolysis problem was one of the factors neglected during this early period.

From the very first appearance of electrolysis, nearly thirty years ago, there has been no end of speculation and uncertainty concerning the whole subject. The difficulty of observing the extent and progress of damage on underground structures; the rapidly changing conditions resulting from extensions, improvements and abandoned power stations; the great variations in local conditions, as, for example, earth resistance and different types of roadbed, as well as many other factors, all contributed to the difficulty of adequately analyzing and solving the problem. Many methods of correcting the trouble were proposed and used, but no standard practice has ever been agreed upon in this country other than the maintenance of the return circuit to the highest standard practicable. The cable-owning interests early found that a substantial degree of protection could be secured by draining the sheaths of the cables in areas where they were found to be positive to the earth, to the negative railway bus or to some other point on the return circuit, and this practice has been and now is consistently followed. The same method was employed, in some cases by the railways and in others by the water and gas companies, in an effort to protect the underground piping systems. This method of electrolysis mitigation, known as pipe drainage, though widely used, is in disrepute among many engineers and pipe-owning companies.

A DECADE OF INVESTIGATION BY THE BUREAU

It was because of the wide divergence of opinion and the lack of engineering knowledge on the subject of electrolysis, as exhibited by many requests for information, that the Bureau of Standards took up a general study of the whole problem in 1910. The first efforts of the bureau in this field were devoted to a study of some of the more important fundamental principles involved. Laboratory and field investigations were carried out and reports were published on many phases of the electrolysis problem. These included electrolysis in concrete; the laws governing the electrolytic corrosion of iron and lead; earth resistance, and its relation to electrolysis of underground structures; leakage resistance of electric railway roadbeds; modern practice in the construction and maintenance

of rail joints and bonds, and the principal methods that have been proposed for electrolysis mitigation. Numerous field surveys were also made by the Bureau of Standards and these have not only formed the basis for a publication on the methods of making electrolysis surveys, but have given an opportunity to experiment with different methods of mitigation. The reports of these various laboratory and field investigations have had a wide distribution and have been very helpful to engineers in bringing about better electrolysis conditions.

AMERICAN COMMITTEE ON ELECTROLYSIS FORMED

In 1913 through the activity of some members of the American Institute of Electrical Engineers, the American committee on electrolysis, first known as the joint national committee on electrolysis, was organized, representing the following organizations in addition to that already mentioned: American Electric Railway Association, American Gas Association, American Railway Engineering Association, American Telephone & Telegraph Company, American Water Works Association, National Electric Light Association, Natural Gas Association, National Bureau of Standards. On Feb. 25, 1914, at the second regular meeting of the committee, the following statement was made as the reason for its formation and is evidence that the committee was fully aware of conditions as they existed at that time:

> Electrolytic controversies have in the past given rise to unnecessary and acrimonious disputes, and not infrequently have resulted in litigation between the corporations concerned. The usual procedure in disputes of this kind has been for each side to employ one or more electrical experts who generally disagree as to the cause of the trouble and the remedies therefore. The dispute sometimes gets into the newspapers, occasioning unpleasant notoriety and resulting in more or less drastic municipal action by the city government concerned. Much of this could be avoided if a body such as this committee could be created which would consider broadly the questions covered by the controversy, without attempting to pass upon the questions at issue, but to report back to their respective organizations so that in time the committee would come to be recognized as a neutral body whose decisions would be authoritative, the same as the standards committee of the American Institute of Electrical Engineers in connection with matters of definition and standardization, which is a recognized authority that nobody ever attempts to question. With that end in view the institute initiated the movement to organize a national body to consider the general subject and agree upon any basic principles or methods of procedure to be followed in the case of electrolysis disputes.

In 1916 the American committee printed a preliminary report for submission to its principals under the following general captions:

I. Principles and Definitions.
II. Methods of Making Electrolysis Surveys.
III. American Practice.
IV. European Practice.
V. Bibliography.

No effort was made to standardize practice or to agree on methods of mitigation.

After the preparation of this report and during the period of the war the committee was inactive. The Bureau of Standards also, except for making a few surveys, devoted all of its activities to military and naval problems for a period of two years or more, so that no material progress in electrolysis mitigation was made during this period.

It thus appears that at the present time, although



MEMBERS AND ALTERNATES OF RESEARCH SUB-COMMITTEE OF AMERICAN ELECTROLYSIS COMMITTEE IN CONFERENCE WITH ENGINEERS OF BUREAU OF STANDARDS

Standing Left to Right—V. B. Phillips, American Electric Railway Association; Burton McCollum, United States Bureau of Standards; Alexander Maxwell, National Electric Light Association.

Seated Left to Right—H. C. Sutton, American Gas Association, secretary; Elam Miller, American Telephone & Telegraph Company; L. A. Hazeltine, American Water Works Association; H. S. Warren, American Telephone & Telegraph Company, chairman; S. S. Wyer, Natural Gas Association; E. R. Shepard, Bureau of Standards.

Missing from Group—Philip Torchio, National Electric Light Association; L. P. Ciccelius, American Electric Railway Association; E. E. Minor, American Water Works Association; E. B. Katté, American Railway Engineering Association.

much valuable research work has been done and the individual utility companies, working independently, have in many cities brought about greatly improved electrolysis conditions, there still remains much difference of opinion as to the applicability of the various methods of mitigation, and the conditions described in 1914 at the organization of this joint committee and which the committee was formed to correct are, in large measure, still prevalent.

SUB-COMMITTEE ON RESEARCH IS NOW AT WORK

In reviving activities a year ago, the American Committee on Electrolysis appointed a research sub-committee to engage actively in technical investigations in co-operation with the Bureau of Standards, for the purpose of securing needed information particularly on controversial questions.

The one subject more than any other upon which engineers have disagreed is pipe drainage. In spite of the wide application of this principle, there is much difference of opinion as to the extent to which it should be used. A number of questions such as, for example, joint electrolysis at high-resistance pipe joints, interchange of current between unequally drained systems, and gas explosions on heavily drained pipes can be settled only by comprehensive study in the field, in co-operation with the local pipe owning companies. The research sub-committee and the Bureau of Standards are accordingly attacking these problems and are receiving the cordial support of a number of water and gas companies. An investigation limited mainly to joint electrolysis has already been carried out in one city and valuable information obtained relating to joint electrolysis and interchange of current between different systems. Similar studies are to be made in a number of other cities and it is hoped that these will form the basis for substantial agreement on the whole subject of pipe drainage. Other methods of mitigation, including the three-wire method of power distribution and reduced feeding distances made possible by the use of automatic substations, will be studied with respect to their applicability under different conditions.

With the street railway and pipe-owning companies and the lead-cable interests all working together in harmony, assisted by the Bureau of Standards, a neutral body, conditions are most favorable for determining the facts relating to electrolysis. It is only by co-operation of this nature that complex problems involving the welfare of so many interests can be adequately dealt with. With this arrangement for co-operation it is not unreasonable to hope that ultimately the American Committee on Electrolysis will be able to report definitely on all methods of mitigation, describing the advantages and limitations of each, and so far as possible recommend suitable standards of practice.

Private Autos Cut Revenue 12 Per Cent

A COMMITTEE of the Massachusetts Legislature appointed to make a study of the cost of operation of motor buses and electric trolley cars has estimated that privately owned automobiles, exclusive of jitneys or motor buses operated for hire, have reduced the income of the traction lines in that State by 12 per cent. If this reduction should be applied to the whole country in proportion to the population the total reduction in electric car earnings would amount to $17,000,000 per year.

Hershey Cuban Railway Being Electrified

Steam Road Connecting Havana, Matanzas and Santa Cruz to Be Equipped for 1,200-Volt Operation, with Automatic Substations

BY F. W. PETERS
Railway & Traction Engineering Department, General Electric Company, Schenectady, N. Y.

HERSHEY Central, a beautifully situated town overlooking the Gulf of Mexico, is located on the north coast of Cuba practically midway between Havana and Matanzas, some 56 miles apart. The major activity here as well as at numerous other "centrals" on the island is the manufacture of sugar. The mill here is served by the Hershey Cuban Railway, having approximately 35 miles of single track, which is now being electrified and extended. With various extensions, short spurs and sidings, there will ultimately be 80 miles of electrified single track.

The service to be maintained will consist of cane and sugar transportation, besides through and local com-



MAP OF PART OF CUBA, SHOWING NEWLY ELECTRIFIED HERSHEY CUBAN RAILWAY

modity freight, express service and multiple-unit passenger train service operating on one-hour headway between Havana and Matanzas.

The 1,200-volt direct-current system will be used, with 10-point catenary trolley wire construction. The overhead will be suspended largely from bracket arms on creosoted pine poles, which will carry in addition the steel-cored aluminum transmission circuits and 795,000 circ.mil aluminum 1,200-volt feeders.

The freight motive power comprises seven 60-ton, four-motor locomotives designed to meet American standards, and the multiple-unit cars will be equipped to make a free running speed of 40 m.p.h. and will weigh about 29 tons. There will be ten straight passenger cars seating fifty persons, three combination passenger and baggage cars and two combination express and mail cars.

The power-generating and substation equipment will be as shown in the accompanying table. This equipment and the buildings in which it will be housed are of modern design and construction in every particular. An interesting thing about the power plant is that on account of the mild climate the boilers have been located out of doors, with only a roof over them for protection against the tropical rains. This affords agreeable work-

ing conditions for the men, and it insures minimum building cost and reduced operating expense, because the boilers are located adjacent to the sugar mill boilers and one boiler house organization can serve both.

The two outlying automatic substations, one of which is located near Havana and the other near Matanzas, are duplicates, each containing one 1,000-kw. group of synchronous converters, consisting of two 500-kw. 600-volt machines connected in series. A third 500-kw. 600-volt spare converter is provided with change-over switches, so that it may be conveniently substituted for either the high or low machine of the group.*



1,200-VOLT LOCOMOTIVE FOR HERSHEY CUBAN RAILWAY

POWER HOUSE AND SUBSTATION DATA—HERSHEY CUBAN RAILWAY

Generating Station	Number
2,500-kva. turbine alternators	3
35-kw. turbine exciter	1
50-kw. motor-generator exciters	1
600-hp. oil-fired steam boilers	4
3,000-kva. step-up transformer banks	2
300-kva. station auxiliary transformer banks	1
Switchboard	1
Spray pond	1
Main Railway Substation	
1,000-kw. 1,200-volt d.c. synchronous converter groups	2
1,050-kva. step-down converter transformer banks	2
Railway switchboard	1
Each of Two Outlying Automatic Substations	
1,000-kw. 1,200-volt d.c. synchronous converter groups	1
1,050-kva. step-down converter transformer banks	1
500-kw. 600-volt d.c. spare converter	1
350-kva. single-phase step-down spare transformer	1
Automatic control equipment	1

The switching equipment is completely automatic in operation and is similar to those which have proved successful in many parts of the United States.

The power transmission is 33,000-volt, three-phase, and provision is made for carrying two transmission circuits on a single line of poles between the power station and Matanzas. These will serve the railway substation on the Matanzas division as well as certain railway and commercial power applications in Matanzas.

On the Havana division immediate provision is made for carrying one three-phase transmission circuit to serve the Havana division railway substation and supply any commercial power demand along the right-of-way. Forty-five-foot creosoted poles of 150-ft. spacing have been used, and the pole line carries at the top a ¼-in. galvanized steel-strand ground wire and either one or two No. 0 steel-reinforced aluminum 33,000-volt three-phase transmission circuits, mounted on pin type insulators and creosoted wood cross-arms.

The contact wire is No. 0000 grooved trolley wire supported from a ⅜-in. galvanized steel-strand messenger, carried on pin type insulators with galvanized tee-iron and bracket-arms. On sidings and special work cross-span suspension is used.

Steel-terminal No. 0000 copper strand acetylene gas-weld rail bonds are used throughout.

To protect against the rapid deterioration of exposed ferrous metals, so prevalent in tropical countries, all iron parts employed in the transmission system are protected by hot-dipped galvanizing or sherardizing.

* A photograph of this rotary converter was reproduced on page 515 of the issue of this paper for March 13, 1920. It is the right-hand illustration. The captions for the two cuts at the bottom of page 515 should be interchanged.

French Cautious Regarding Inductive Interference

THE French technical papers have given much space recently to an article by J. B. Pomey, who was a member of the French Electrification Commission which visited the United States about a year ago. The article appeared originally in the issue of the *Annales des Postes, Télégraphes et Téléphones*, for December, 1919, p. 566. While this article covers the general observations of the author made during his visit to this country, it gives special attention to the inductive influence exerted by traction lines on communication circuits.

The principal point in this connection is that conditions in France and the United States are so different that it may not be practicable to apply directly the solutions of the inductive interference problems in France which have been successfully developed in the United States. As to inductive interference from direct current traction systems, he points out that while up to the present time the direct-current system has not interfered with the communication lines, it will not be wise to generalize too much as yet. More sensitive communication apparatus may be used in the future and, on the other hand, the volume of the current used in heavy electric traction will increase.

Mr. Pomey refers appreciatively to the use of the high-speed circuit breaker on the St. Paul electrification, which prevents the increase of short-circuit current to unmanageable values. He recommends that in the choice of a system of electrification for France the characteristic influences of the system upon the neighboring communication circuits be studied by means of the oscillograph. The effect of the operation of high-speed circuit breakers must be included in the study.

Costs Increase 75 Per Cent

THE report of the Committee of One Hundred of the Kansas City, Mo. Chamber of Commerce on the local traction situation shows that the local cost of service per revenue passenger carried has increased 75 per cent since 1915. The accompanying table shows the cost of carrying each passenger, as compared with the fare received, in each of the five years during which the present franchise has been in operation:

	1915	1916	1917	1918	1919	Per Cent Increase Over 1915
Operating ratio (per cent)	69 90	68 21	69 88	86 16	106 34	62 2
Unit rate of fare (cents)	5	5	5	5	6	20 0
Revenue passenger relatives						
Average fare (cents)	4 87	4 97	4 97	4 98	5 81	19 3
Operating expenses and taxes (cents)	3 57	3 57	3 63	4 47	6 57	84 2
Fixed charges (cents)	1 16	0 97	1 08	1 20	1 72	48 3
Operating expenses, taxes and fixed charges (cents)	4 73	* 4 54	4 72	5 68	8 30	75 8
Profit or loss (cents)	0 14	0 43	0 25	*0 70	*2 49	

* Loss

Holding Down Load Peaks on the St. Paul

By Automatic and Manual Means a Load Factor of Nearly 60 Per Cent Is Obtained—Load-Totalizing Instruments Play an Important Part

BY J. J. LINEBAUGH
Railway & Traction Engineering Department, General Electric Company, Schenectady, N. Y.

THE power limiting and indicating system constitutes one of the many novel features developed and installed as part of the original equipment furnished by the General Electric Company to the Chicago, Milwaukee & St. Paul Railroad for the electrification of its Rocky Mountain and Missoula Divisions. The railway desired to obtain an equipment which, with heavy trains comparatively few in number, would give the highest load factor consistent with good railroading. The Montana Power Company, which furnishes power to this section of the railroad, desired to prevent excessive peaks, which might cause serious voltage variations which would require the installation of excess-generating apparatus to take care of the railway load. The power company desired also to obtain means by which the total power supplied to the railway transmission line at a number of points could be accurately recorded at one place and on one meter and to obtain proper peak-load data upon which to base the price of power.

The apparatus described below was built, installed and tried out on the 220-mile Rocky Mountain Division before similar equipment was supplied to the 220-mile Missoula Division.

The equipment for the Rocky Mountain Division as first installed was based on metering the power at the five feed-in points. It was later changed to meter the power at the low-tension side of the motor-generator set step-down transformers in each substation, in order that the high-tension transmission line of the railway company might be employed for emergency power transfer, by the power company. This was not necessary on the Missoula Division, with but two feed-in points.*

NINE FUNCTIONS OF THE CONTROL EQUIPMENT

All of the indicating and recording apparatus for both divisions is installed in the dispatcher's office at Deer Lodge, Mont., the center of the 440-mile electrification. The complete system comprises the distinct functions of limiting the maximum power demand at the will of the train dispatcher and of indicating and recording the total net power. The combination of these two functions accomplishes the following results:

1. Independent of the number of feed-in points, it indicates to the train dispatcher at all times the total net amount of energy being delivered to his division and it makes a permanent record for future study and as a basis for power bills.

2. It automatically deducts regenerated power if returned to the power company's lines or transfer of power from one line to another over the railway company's transmission line.

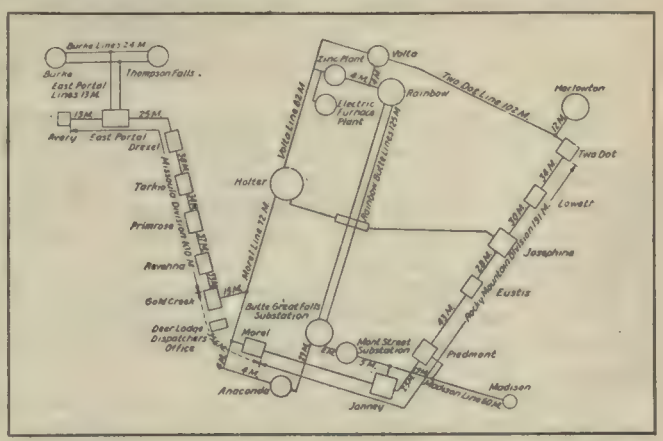
3. It automatically limits the amount of power supplied to the division by lowering the trolley voltage and slowing down the trains so that the maximum peak load on the system cannot exceed a certain predetermined maximum.

4. Its maximum limit can be changed instantly, easily, accurately and directly by the dispatcher without the necessity of notifying substation operators.

5. It is capable of reducing the peak-power demand by 30 per cent.

6. If desired, the equipment can be adjusted so that the lightly loaded substations will not be affected, thereby providing the highest possible voltage for the operation of passenger trains.

7. If desired, the equipment can be adjusted to reduce the voltage on the most heavily loaded substations at the time of peak demand (above the maximum limit)



CONNECTION DIAGRAM FOR ST. PAUL ELECTRIFICATION, ROCKY MOUNTAIN AND MISSOULA DIVISIONS

Showing connections of the 100,000-volt system of the Montana Power Co. and transmission lines of the railroad, with location of the 3,000-volt direct-current railway substations.

slightly in advance of the other stations, thereby tending to equalize the load on all the stations.

8. If an excessive demand for power occurs near any one substation the voltage of that substation is automatically lowered without affecting the voltage of the other substations, dividing the load between the substation affected and the stations on either side.

9. The total power fed in at any point or transferred from one power line to another or the amount returned due to regeneration can be easily taken care of by a change in the ratio of the current transformers or by an adjustment of the wattmeter rheostats.

CONTROL CIRCUIT A GIANT OHM-METER

The system is essentially an ohm-meter on a large scale, consisting of a two-wire pilot circuit, extending the length of the division, connecting in series all of the substations and the train dispatcher's office, with contact-making wattmeters and suitable rheostats at the incoming power points, and contact-making ammeters, with voltage-lowering generator rheostats in each substation.

*A brief reference to this system will be found in the abstract of the 1920 report of the committee on electricity of the American Railway Engineering Association in the issue of this paper for April 3, page 695.

A constant source of direct-current potential is applied across the two ends of the pilot wire loop at the dispatcher's office, power being obtained from a 2-kw. 1,200-volt direct-current motor-generator set, the voltage of which is held constant by a standard voltage regulator. The voltage applied to the pilot wire is determined by the length of the division, the resistance of



DISPATCHER'S OFFICE AT DEER LODGE, SHOWING POWER LIMITING AND INDICATING EQUIPMENT

the pilot wire, the number of substations and the power feed-in points.

The indicating and limiting feature is obtained by inserting or removing a certain number of ohms of resistance for a definite change in the kilowatt demand, which causes a definite decrease or increase in the current flowing in the circuit when a constant voltage is held across the pilot wire.

The contact-making wattmeter resistances and the pilot-wire contact-making ammeters are connected in series with the pilot wire, as shown in an accompanying diagram.

The apparatus is designed to hold certain definite peak limits in 2,000-kw. steps from 10,000 to 25,000 kw. as indicated.

The power-indicating apparatus in the dispatcher's office consists of a 2-kw. motor-generator set, a milliammeter calibrated in kilowatts, a curve-drawing ammeter, also calibrated in kilowatts; a curve drawing voltmeter, to give a permanent record of the pilot-wire voltage, and suitable indicating instruments and switchboard to control the motor-generator set.

Due to the simplicity of the indicating wattmeters, two of these have been installed for each division, one on the switchboard and the other in front of the trick train dispatcher. With this arrangement the dispatcher can tell at a glance the exact amount of power being taken in his division at any instant, and also can watch the power demand resulting from his orders to the train crews in charge of trains ascending or descending the mountain grade.

Variation in resistance of the pilot wire due to change in temperature is taken care of in the dispatcher's office by a rheostat which can be easily inserted and the total resistance adjusted to 2,000 ohms (the approximate resistance of the pilot-wire loop and the coils of the contact-making ammeters), by holding 1,200 volts and adjusting the rheostat for 0.6 amp.

The contact-making wattmeter equipment consists of a contact-making wattmeter built along standard meter lines, with an indicating pointer equipped with contacts and moving between the two stationary contacts. The spiral spring of the pointer is connected to the shaft of the pilot-wire rheostat located immediately above the wattmeter. This shaft is driven by the motor-driven clutch mechanism at the top of the supporting framework. When contact is made on one side, due to an increase in incoming power, the circuit is completed through the clutch coils, causing the rheostat gearing to engage and inserting a certain amount of resistance in the pilot wire. At the same time the wattmeter spring is wound up due to the movement of the shaft. This action continues until the torque of the wattmeter is offset by the torque of the spring, when a balance is obtained and the clutch circuit is interrupted, thereby causing the rheostat to come to a standstill. This operation is continued for any increase or decrease in the incoming power.

How the Peaks Are Held Down

The power-limiting scheme in connection with the indicating equipment consists of a contact-making ammeter for each substation, with its coil connected in series with the pilot-wire circuit, so that when the current in the pilot wire decreases to a certain predetermined point contact is made and resistance is inserted in the exciter circuits supplying excitation to the separately excited direct-current generators by means of a motor-operated rheostat. The rheostats have sufficient resistance to lower the substation voltage to a minimum of 2,100. When contact is made by the contact-making



POWER LIMITING AND INDICATING EQUIPMENT INSTALLED IN JANNEY SUBSTATION, SHOWING PLUG-SWITCH PANEL

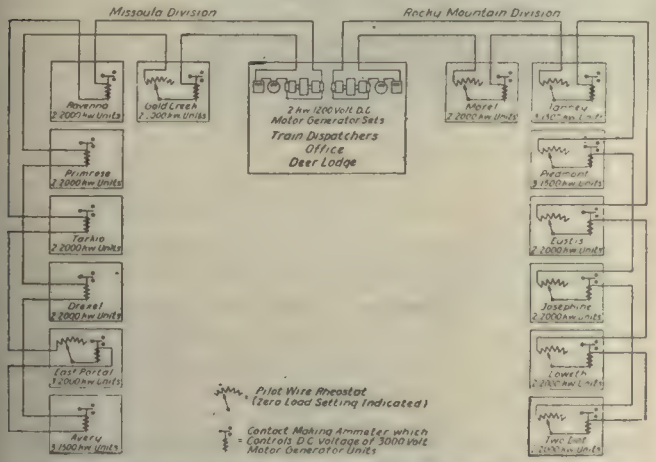
ammeter the voltage of the substation is decreased, and the resulting slowing down of the trains reduces the total input of the substation to a value below the predetermined peak setting. When the total load becomes less than the peak setting the contact-making ammeter will make contact on the other side and bring the voltage of the substation back to normal. A secondary current coil forms part of the contact-making ammeter and is

energized with current from a direct-current shunt in the ground or negative side of the 3,000-volt substation, so that the heavily loaded substations have their voltage decreased slightly before those with lighter loads.

If the total alternating-current input is beyond that covered by the power contract, or limit determined by the train dispatcher, the voltage of all of the substations will be decreased until the total input reaches the amount decided upon.

An overload and an underload relay are also connected across the current shunt. The latter is calibrated to make contact at about one-half load on a substation, so that the limiting equipment is inoperative until the load is greater than this amount. The overload relay is set to take control of the motor-operated rheostats at three times load and prevents the load going above this amount by lowering the voltage independently of the power-limiting equipment which transfers some of the load to the substations on either side.

If the power demand should be greater than the peak limit while a locomotive is regenerating through a sub-



CONNECTION DIAGRAM FOR THE PILOT-WIRE CIRCUIT AND LOCATION OF CONTACT-MAKING WATTMETERS

station the reverse-current relay in each substation (primarily used to give correct field connections of the synchronous motor exciters) is also arranged to open one of the control circuits so that the voltage-lowering rheostats are inoperative. With this arrangement the potential is held constant at 3,000 volts. If the voltage should be below normal, due to operation of the power-limiting equipment, and regeneration should occur, the voltage is automatically brought back to 3,000 and held at this value.

The maximum kilowatt peak limit, or kilowatt setting, can be changed at any time by the train dispatcher to take care of unusual congestion or other requirements.

Due to the necessity of reducing the pilot-wire current to the same value, the kilowatt totalizing meters, which are ammeters calibrated in kilowatts, must record correctly the total kilowatts, although finally carrying the same amperes. This is accomplished by gearing the several rheostats together with a common rheostat handwheel. This changes the voltage through the regulator by definite steps and also changes, at the same time, by definite increments the resistance across the coils of the two kilowatt meters, thus altering the current required to give any definite scale indication in the ratio of the change made at the same time in the pilot-wire voltage. By this means the current at which the contact-making ammeter makes contact can be made to represent 10,000 kw., 12,000 kw., etc., up to 20,000 kw., by simply turning the rheostat handwheel to definite points plainly marked, correctly connecting the three different circuits.

Load Factor Is Now Practically 60 Per Cent

The lowering of the trolley voltage in the substation is accomplished slowly enough, by proper speed of the motor-operated field rheostat, so as not to affect the operation objectionably, the only result being a gradual slowing down of the trains.

Additional power limiting is also obtained by instructing the freight engineers to drop back to series connection of the locomotive motors if very low trolley voltage is indicated by the voltmeters in each locomotive cab.

The peak limit was set at 14,000 kw. for the Rocky Mountain Division on April 1, 1919, and operation has been very satisfactory on this basis. The average load factor from April to September, 1919, inclusive, was 56.8 per cent.

The railway pays 0.536 cent per kilowatt-hour for 60 per cent of the peak, irrespective of whether this amount is actually used or not. The load factor maintained is so nearly 60 per cent that the increase in cost of power, or the cost of power not used, is very slight. With increase in the number of trains the load factor will be raised and no difficulty should be experienced in holding a load factor of 60 per cent or better. If the power-limiting feature is removed peaks as great as 21,000 kw. to 22,000 kw. would result.

One of the great indirect benefits obtained is the valuable assistance the indicating equipment gives the train dispatcher in dispatching trains in such a manner as not to give excessive peaks, and thereby lower the voltage due to the power-limiting equipment. By careful train dispatching, so that one train is ascending the mountain grade while another train is descending, it is possible to assist the automatic equipment in maintaining a good load factor very materially and greatly to increase the efficiency of the general operation of the railroad.

In the development of the apparatus described above great credit is due E. S. Johnson, J. R. Craighead, J. B. Taylor and E. J. Thiele for valuable suggestions, improvements and assistance in working out the details of the great number of new and untried features.

Kansas City Railway Installs Its Own Printing Plant

THE Kansas City (Mo.) Railways has installed a complete composition, printing and binding plant which is adequate to supply all of the company's printing needs except tickets and transfers. It is installed in a modern fireproof building with high ceilings and natural light and occupies 3,400 sq.ft. of floor space. The composing room is equipped with all sizes and faces of type and the necessary type cases, form stones, etc. The equipment of the press room includes a 35 x 47-in. bed Whitlock cylinder press for printing the weekly and monthly editions of the *Railwayan* and other large forms, a 12 x 18-in. Gordon press having a Miller automatic feeder and a 10 x 15-in. Gordon press for small forms. There is also a semi-automatic power paper cutter. The bindery is equipped with a wire stitching machine, a punching machine and a folding machine.

North Shore Line Adopts Safety Cars

Initial Installation of Ten Cars Shows an Increase in Gross Revenue as a Result of the Improved Service—Some Changes in Car Design Are Described



WAUKEGAN SAFETY CAR WITH NEW TYPE OF TRUCK

AN INITIAL installation of ten safety cars has been made in Waukegan, Ill., by the Chicago, North Shore & Milwaukee Railroad. This number is sufficient to equip the North Avenue line completely except for rush-hour service. This line runs from the Great Lakes Naval Training Station through North Chicago to the northern limits of Waukegan, a distance of nearly 6 miles. By the use of these safety cars the headway on this line has been reduced from fifteen minutes to eight minutes. The running time for a trip one way is thirty minutes, which is equivalent to a schedule speed of 11.56 m.p.h., not including lay-overs. The car mileage operated has been increased from 816 per day to 1,778. The safety car operators are paid a bonus of 10 cents per hour, bringing their total hourly rate up to 60 cents.

An interesting feature of this installation is that the safety cars operate over the through Chicago-Milwaukee interurban tracks for about one-half of the distance. They are thus sandwiched in among the local and limited interurban trains, express cars and freight trains. This operation over the interurban tracks necessitated the use of wheels with 4½-in. treads in order safely to negotiate the special track work and to operate the automatic crossing signals. Also, to meet the interurban requirements, the safety cars were equipped with whistles.

Another feature of the installation is that it embodies a change from two-man, pay-within operation to one-man, pay-as-you-enter operation, employing registering fare boxes. The increase of more than 100 per cent in service noted above has resulted. For the first fourteen days of March there was an increase of 35 per cent in the gross earnings, as compared with the corresponding period last year. Since the number of men at the Naval Training Station is materially less than it was a year ago, officials of the company attribute this increase in growth almost entirely to the better service and to the fact, also, that the pay-enter, fare-box collection has resulted in the men being able to get all of the fares.

The showing thus made after only about three weeks of operation gives rise to the evident probability that Britton I. Budd, president, will order additional safety cars in the near future in order to make the installation 100 per cent complete in Waukegan. As only two cars on a ten-minute headway are required for the Electric Park line, which is the other of the two lines in Waukegan, ten safety cars additional would provide the complete Waukegan service, both normal and rush-hour.

THE SAFETY CAR "SOLD" TO WAUKEGAN

The installation of the safety car in Waukegan was not made without considerable opposition. Speaking of this, Mr. Budd said that the city authorities, the trainmen, the newspapers, and seemingly everybody, were opposed to their introduction. In view of this attitude, Mr. Budd personally met with the trainmen and with the Mayor and other public officials and worked with them until he succeeded in either winning their support or at least a neutral attitude.

Mr. Budd simply endeavored to "sell" the idea of the cars. He showed the people that the local company had lost a considerable sum of money last year and that this meant either an increase in fare or a reduction in operating expenses. The safety car offered the opportunity to reduce operating expenses. Moreover, Mr. Budd promised a much improved service if the safety cars were permitted, the combination of better service and less expense per car-mile offering the possibility that the net earnings could be increased so that operation could be continued without an increase in fares.

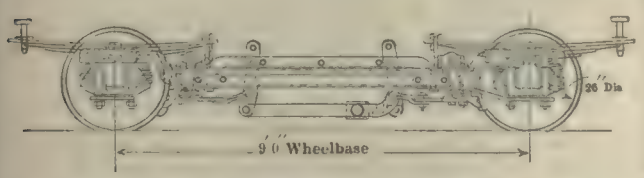
The trainmen were won over through Mr. Budd's efforts and the promise of 10 cents an hour additional pay.

When the cars were finally installed the greatest care

and an abundance of supervision were provided to make certain that there should be no bad first impressions. While some of the operators were a little slow the first day or two, the people in general were not only not dissatisfied, but were enthusiastic in their approval of the cars, and particularly of the noticeable improvement in the frequency and speed of the service.

MECHANICAL FEATURES OF THE CAR

The ten safety cars purchased by the North Shore Line were built by the Cincinnati Car Company and



SIDE ELEVATION OF SAFETY CAR TRUCK AS USED AT WAUKEGAN

mounted on that company's standard safety-car truck, the present design having been used also on the twenty-five safety cars recently shipped to the Birmingham Railway, Light & Power Company. These trucks have a 9-ft. wheelbase. Other details of their construction are shown in the accompanying elevation drawing. The car body is mounted on the outer ends of the semi-elliptic springs, without the use of any intermediary coil springs, as has been customary in other safety-car trucks. The opposite or inside ends of the elliptic springs are connected with the side frame of the truck through a swinging link, and the side-frame members rest on a pair of pedestal springs at either journal box. The substitution of the coil springs at the pedestals for the more usual coil springs at the outer ends of the elliptic spring was made for the reason that it is thereby possible to use a longer spring.

The wheels used on the North Shore cars are 26-in. rolled steel. The motors are the G.E. 264-A type with



HEAD LINING, SIDE SHEATHING AND DOUBLE FLOORING WERE USED IN THE WAUKEGAN SAFETY CARS

friction bearings. The truck journals are also of the friction-bearing type. All bearings in the brake rigging are steel bushed and all pins are case hardened. The brakeshoe and brake rigging wear is taken up by Gould slack adjusters.

The car body differs from the standard safety-car design in several respects. It is standard so far as dimensions and general construction go and as to the seating arrangement and the seating capacity of thirty-two. The underframe has been strengthened to conform to the requirements outlined by H. A. Johnson, superintendent of equipment of the Chicago Elevated Railways and Chicago North Shore & Milwaukee Railroad. Then inside the car, to provide for the cold weather which prevails on the shore of Lake Michigan at Waukegan, agasote sheathing and head lining was put in from the floor to the window sill or arm rest and again behind the advertising racks and over the ceiling. Further provision was made for cold weather through the generous use of electric heaters, each car being equipped with sixteen Consolidated Car Heating Company, No. 303, 500-watt trussplank heaters, which are controlled by a utility thermostat set at 60 deg. A double flooring of $\frac{13}{16}$-in. yellow pine with maple floor strips on top of this in the aisle was used.

Each car is also equipped with an International registering fare box, eight Railway Utility Company automatic ventilators, Golden Glow headlights, curtains doublefaced with pantasote, Economy watt-hour meters, H-B lifeguards, etc.

For coupling purposes a hole was provided down through the dash behind the bumper channel and a longitudinal hole cut through the web of the channel to admit the drawbar. The total weight of the car with this additional metal in the underframe, the inside finishing, etc., runs for the ten cars from 17,100 lb. to 17,400 lb., averaging 17,288 lb.

Letters to the Editors

Lack of Drainage, Shrinkage of Concrete and Difficulty of Repair Are Faults of Concrete Beam Track

DES MOINES CITY RAILWAY COMPANY
DES MOINES, IOWA, March 29, 1920.

To the Editors:

I have noted the article on page 609 of the March 20 ELECTRIC RAILWAY JOURNAL, describing a type of track construction in which the rails are supported on concrete stringers without the use of ties.

In studying this design it first occurs to me that the shaping of the subgrade would not only be difficult but also expensive. It would be impossible to roll it as is advisable in many classes of soil. The inefficiency of present day labor would certainly necessitate extremely close supervision and would result in slow and tedious work in order to secure an accurate cross-section, which must be exact both as to line and grade.

There is no provision for drainage which is so necessary in many soils. I have never actually tried out the concrete beam design, without the use of ties; nor have I had any experience in connection with concrete as a paving surface in tracks. It has been my understanding that these ideas have proved failures in places where they have been used, and I have tried to benefit by the experience of others in this respect.

The article does not describe in detail the method of

procedure during construction. It is assumed that the rails are blocked up and the plates, rods, hook bolts and all reinforcing are attached and bolted up, after which the concrete is poured. This would not permit any adjustment or tightening down of clips after first placing and the slight shrinkage of concrete might leave the rails a little loose.

My chief objection to absolutely rigid construction of any kind is, that while it will stay in good condition for a certain length of time, there will be a time when maintenance will be necessary in order to get maximum life out of the rails; and it is almost impossible to do any maintenance on this rigid construction and entire reconstruction is necessary. Where there is a cushion or parting strip between ties and foundation (whether the foundation is concrete or loose ballast) tracks can be overhauled and retamped, gaged or relined without as much expense as entire reconstruction There is also the objection to rigid construction that it is noisy and harder on equipment.

The statement in this article that concrete presents a wearing surface "far superior to other types of pavement in connection with railway work" is, I am sure, misleading. Either granite block or good brick in my opinion will give better results. A hole in granite or brick pavement can be repaired and placed under traffic almost immediately, whereas with concrete, asphalt or any other surface cast in place, it is necessary to allow a certain length of time for the concrete to set or harden before traffic should be turned over it, and this is very hard to do when cars are in operation.

I believe we had better stick to the old plain rectangular foundation of some kind, continue to use a track tie and provide drainage for the sub-soil and probably more water proofing of paving surfaces to prevent frost from heaving the track in winter and water from churning in wet summer weather.

W. L. WILSON,
Chief Engineer M. of W. & S. Dept.

Book of Instructions for the Track Department

NEW YORK STATE RAILWAYS
ROCHESTER, N. Y., March 17, 1920.

To the Editors:

In the January 17, 1920, issue of the ELECTRIC RAILWAY JOURNAL the writer had an article giving formulas for the solution of compound curve problems and mentioned that these formulas were taken from a "book of instructions" originated by him for use of the engineering department of this railway. Because of the number of inquiries received concerning this book, a general description of form and contents is given here for those who are interested.

These instructions are typewritten on 8½ in. x 11 in. standard correspondence size paper and bound in a loose leaf cover. This size has been found to be the most convenient for all purposes, especially as most of the pages are typewritten and the drawings of the company are made in multiples of this size. For all typewritten pages onion skin paper is used and all typewritten work is backed up with carbon so it may be blueprinted. The book is made loose leaf because it is continually being revised and new matter added. It has not been published for the reason stated above and because much of the information deals with the particular methods and customs used only by this one company. A table of contents is given below showing the sections into which it is divided and the subjects covered under each section. These sections are separated by heavy manila separators having thumb indexes, upon which the subjects covered are printed.

TABLE OF CONTENTS OF BOOK OF INSTRUCTIONS FOR ENGINEERING DEPARTMENT

1. Track measurement—Detail instructions for chaining track for the track report and making up the same.
2. Special Work Renewals—
   1. Detail instructions for special work measurements.
   2. Standard dimensions of switches and mates.
   3. Instruction for special work data sheets (drawings for renewals).
   4. Instructions for ordering special work.
   5. Instructions for recording special work when placed.
   6. Tables of wheel tread data and minimum width of grooves (for special work manufacture).
   7. Special work specifications (for steel companies).
   8. Instructions for hard center and tongue renewals.
   9. Drawings showing method of planing rails, draining switches, etc.
3. Drafting—Gives full directions regarding standard sizes, titles, drawing numbers, conventional signs, etc.
4. Detail rules for filing, recording and indexing plans.
5. Estimating—Detail directions for getting out the company's standard estimates for authorizations explaining difference between additions, betterments, replacements and operating charges (according to N. Y. State P. S. C.) and a table of unit prices and quantities for 100 ft. of track.
6. Engineering data—
   1. Table of logs and middle ordinates for common standard radii.
   2. Table of rail sections in common use on lines.
   3. Compound curve formulas and special problems commonly met.
   4. Table giving drilling, size of holes, bolts, etc., for various kinds.
   5. Super-elevation charts
   6. Drawings with complete details of company's standard specials.
   7. Loading diagrams of cars.
   8. Small printed maps of all car lines of system.
7. Specifications—All companies' standard forms of specifications and contracts, covering specifications for ties, paving and other materials, painting, building, crossings, licenses, etc.
8. Instructions for making the state tax report including unit prices and tables of depreciation for various constructions.
9. Instructions for Public Service Commission reports giving full details how each blank is filled out and where the information is obtained.
10. Instructions for making the company's annual statistical report.

This "book of instructions" is the outcome of several years' experience and the belief of the writer that written instructions are an important aid to efficiency in engineering as well as in other work.

L. R. BROWN,
Office and Field Engineer.

Pulverized Coal Under Boilers

GREEN ENGINEERING COMPANY
EAST CHICAGO, IND., April 2, 1920.

To the Editors:

In regard to the results obtained with powdered fuel in Milwaukee as outlined in the article by John Anderson on page 473 of the March 6 issue of ELECTRIC RAILWAY JOURNAL, the writer believes it is fundamentally wrong to take coal and prepare it to the most expensive condition (powder) and still burn it in its raw state, *i. e.*, with all its hydrocarbons. A much more fertile field of research and more rational procedure would be to extract some or all of the byproducts, leaving coke and gas for fuel. Ultimately we must come to some such process in this country, and until that time it will be difficult to find a complete analysis of figures that will show anything but a loss for powdered fuel as compared to stoker firing.

The ash carried out by the chimney gases is a serious matter. It is reported as high as 82.8 per cent of the ash content of the coal. This is an item that should not be lightly passed. It is not sufficient simply to state that it is "apparently carried a long distance" or that "no deposit could be noticed in the street." Some accurate way of measuring this discharge should be found before definite statements concerning it are made.

In figuring the cost of coal preparation only the equivalent fuel cost was charged, and that at the rate of 1.5 lb. of coal per kilowatt-hour. This figures 17,826 B.t.u. per kilowatt-hour. Few, if any, stations can assume such economy as this. The correct figure for cost of current should include all items—coal, labor, capital charges, in fact everything that goes to make up the ultimate cost of kilowatt-hour at the point of consumption. The author of the paper is misleading himself by using only partial costs for fuel preparation.

The cement industry has used powdered coal for twenty years and no doubt has much more data on the subject than steam producers. Such plants, with established cost figures, find that it costs in excess of $1 per ton to prepare the coal. If complete costs were figured for the Milwaukee installation, the cost of preparation would probably approach this figure and more than offset the alleged saving.

The stokers with which the comparison was made had a difference of 5.9 per cent between the gross and net efficiency. They were old and have auxiliaries costly to operate, reducing the gross or apparent efficiency to a net figure below that which can be obtained with other stokers. With modern chain-grate stokers, the net efficiency when operating at any such ratings as shown in this report is in excess of 76 per cent. Such a figure shows 5 per cent in favor of stoker firing over pulverized fuel.

From the author's presentation of the subject, the writer believes that the ash nuisance is unsolved and that in order to present even a slight saving in favor of pulverized coal it is necessary to: (a) Use low moisture coal. (b) Omit interest and depreciation on the additional investment. (c) Omit a large part of the cost of preparing the fuel. (d) Compare with underfeed stokers having low net efficiencies due to auxiliaries expensive to operate.

With these items corrected, the showing is in favor of stoker firing. T. A. MARSH, Chief Engineer.

Association News

Active Membership Campaign Planned

THE company membership committee of the American Electric Railway Association will make an extensive campaign for a 100 per cent enrollment of all electric railway companies in the United States this summer. This was the action taken at a meeting of the committee in Toledo on March 30. Each member of the committee will be allotted two or three states and will be empowered to select an assistant and visit personally every company in his district. The committee members were unanimous in the desirability of binding the electric railways into the association at this time when all other factors are organizing. Secretary E. B. Burritt, New York, was present. Others who attended the meeting were L. E. Gould, Chicago; J. P. Barnes, Schenectady, N. Y.; C. A. Hall, Pottsville, Pa.; E. B. Moore, Fairmount, W. Va., and J. W. Welsh, New York. The committee members were guests of President Frank R. Coates of the Toledo Railways & Light Company. They took lunch at the Toledo Club and dined at the Minority Prophets' Club, where Mr. Doherty was also present. In the afternoon they were taken on a tour to the Willys-Overland plant, one of the largest users of electric current in the Middle West. The committee has already begun work, two new members having been secured since the meeting by Mr. Barnes.

Committee for Chamber of Commerce Meeting

SECRETARY BURRITT announced this week the names of the alternate delegates of the association to the meeting of the United States Chamber of Commerce at Atlantic City on April 27-29. The list of delegates and alternates follows:

National councillor and delegate: L. S. Storrs; alternate, Britton I. Budd.

Delegates: J. N. Shannahan, W. A. Draper, P. J. Kealy, B. A. Hegeman, Jr., Charles L. Henry.

Alternates: C. M. Clark, James H. Drew, C. C. Peirce, E. C. Faber, E. B. Meissner, M. B. Lambert, H. W. Blake.

Secretary Burritt is anxious to learn of any members of the electric railway industry who expect to attend the meeting as representatives of their local Chamber or Board of Trade. A gathering of railway men in attendance will probably be arranged to discuss any matters of interest to the industry which may arise.

The preliminary program for the transportation section of the meeting is printed on page 771 of this issue. No special public utility section meetings are scheduled this year, the electric railways being included in the transportation group.

Coming Committee Meetings

THE committee on merchandising transportation of the Transportation & Traffic Association will hold a meeting in New York on April 12.

The committee on way matters of the Engineering Association is to meet in New York on April 15-16.

The committee on express and freight traffic facilities and cost of the Transportation & Traffic Association will meet in New York on April 26.

The committee on heavy electric traction of the Engineering Association is to meet in New York on April 28.

A meeting of the equipment committee of the Engineering Association is scheduled for May 7. It will be held in New York City.

Convention Location Committee

H. FORT FLOWERS finds that it will be impracticable for him to serve upon the American Association convention location committee. William F. Hurlburt, sales manager of the Metal & Thermit Corporation, has been appointed in his place.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

City Ownership Rejected

Wisconsin City Votes Three to One After Tart Campaign Not to Take Over Railway

Municipal ownership has been rejected in Madison, Wis. The voters of that city on April 6 turned down three to one the proposal to have the city purchase the lines of the Madison Railways. The company through paid newspaper advertising led the opposition to the purchase. Labor organizations and labor members in the Common Council led in the fight to buy the lines. It is expected that the City Council will now vote to co-operate with the railway and permit the installation of one-man cars on all lines.

Seven Years of Uncertainty

The railway question has been before the people of Madison for seven years. The municipal ownership advocates based their fight on the ground that the company could not make the necessary extensions and provide better service without raising the fares. Since November, 1918, the rate in Madison has been 6 cents. Opponents of the plan pointed to the fact that the Madison Railways purchased "a streak of rust" and converted it into railway; that with reasonable co-operation on the part of Madison citizens the company could build extensions and continue to improve the service.

Two investigations of the service and finances of the Madison Railways were completed recently. One was conducted by a committee of citizens and Aldermen named by Mayor George C. Sayle; the other was conducted by the Wisconsin Railroad Commission.

The citizens-Council committee reported to the Council that with city co-operation in the matter of paving and the installation of one-man cars on all lines the company could continue on a 6-cent fare, build extensions and provide better equipment and service. The Railroad Commission reported to the effect that service could not be improved until practically the entire system was double-tracked, more rolling stock provided and cars operated under closer supervision.

Spirited Campaign Conducted

In the campaign against municipal ownership it was pointed out that should the citizens vote to purchase the lines, it would mean at least two years before the city could take up actual operation, because after the Railroad Commission had fixed a valuation on the property, the matter would probably be carried to the Circuit Court and thence to the Wisconsin Supreme Court. This would mean two years in which no improvements would be made by the railway. On the other hand, it was stated that should municipal ownership be defeated, the city would then take up the matter of putting into effect the recommendations of the citizens-Council committee.

Under a city ordinance, passed in the days of horse cars and still operative, the railway at Madison is forced to pay for paving between its rails. The city now has paving claims of nearly $50,000 against the company, with much more paving in prospect this year. In its report to the Council, the committee urged that the present debt of the company to the city be arranged for payment in annual instalments. Future costs would be met in the same manner, under the committee's plan.

With permission from the Railroad Commission and the City Council, the company has been operating five rebuilt one-man cars. The committee urged that these be replaced by one-man safety cars. The company is building a 2½-mile extension on the Winnebago line to the plant of the Mayer Packing Company at a cost of $40,000. This money was raised by public subscription through the efforts of the Association of Commerce, contributors to the fund receiving preferred stock on which dividends will be deferred for five years. This was made necessary by the refusal of the Mayer company to consider locating at Madison until the railway was extended to the plant.

One-Man Cars Protested

Employees of certain electric railways in New Jersey have asked the Board of Public Utility Commissioners for a hearing on their application in protest against the operation of the one-man cars. In a reply Alfred N. Barber, secretary of the board, points out that the commission cannot compel a company to stop operating such cars in the absence of public complaint and evidence showing their operation to be against the public interest. As the question of the safety of the service is one which concerns the employees of the company it would be the duty of the board to entertain the complaint of the men and afford them a hearing.

The one-man cars are operated by the Trenton & Mercer County Traction Company, Trenton, N. J., and the Morris County Traction Company, Morristown, N. J., and so far no complaint has been made against them. Rankin Johnson, president of the former company, says that it is not the intention of his company to cause a loss of work to any of its employees because of the installation of the cars.

Assist in Track Renewals

New State Law Provides That City Can Do Work and Company Repay in Ten Instalments

Through an amendment to the general code known as Senate Bill No. 211 the General Assembly of the State of Ohio has made it possible for a municipality to finance the renewal, repair or reconstruction of the track of a street railway at the time the street is paved, the cost being subsequently assessed against the company in ten equal annual instalments plus 6 per cent interest. It is understood that the Pennsylvania-Ohio Electric Company, Youngstown, will spend $500,000 on reconstruction this year on this plan.

Governor Signed Bill Promptly

The bill recently signed by Governor Cox provides that a City Council may by ordinance order a street railway to renew, replace or reconstruct its track and roadbed at the time the street is torn up for paving or resurfacing. If a company is dissatisfied with the ordinance provision is made that within ten days after its passage it may file a complaint or appeal to the Public Utilities Commission. The commission is thereafter charged with the duty of hearing and determining the case within thirty days, either approving, modifying, or reversing the action of the local Council. If the railway then fails to notify the local Council in writing that it will do the indicated construction work directed by the commission, or if without appeal, by the City Council, then it is provided that the Council itself may by ordinance contract for such renewal or reconstruction of the track and roadbed. In this case, it is understood that the railway may bid on the work and secure the contract on a competitive basis.

Paving Charge a Lien

The code provides that the Council shall by ordinance assess the entire cost of the labor and material required for the work against the railway, and upon failure of the latter to pay the assessment in cash it becomes a lien upon all of the property of the company located within the city. This assessing ordinance must provide for the payment of the assessments in ten equal annual instalments with interest until paid at not to exceed 6 per cent per annum; provided, however, that the company shall not be liable for any instalment of the assessment falling due after the expiration of the company's franchise unless the use of the track is continued thereafter by the company.

Municipal Ownership Approved in Detroit

City Decides to Go Into Railway Business for Itself in Competition with Detroit United Railway

Mayor Couzens' plan for the construction and acquisition of street-car lines by the city was approved by the voters of Detroit, Mich., on April 6, by a majority vote of about 64 per cent. A majority of 60 per cent was necessary to carry the election. Contrary to expectations, only about 140,000 votes were cast out of a registration of more than 330,000 voters, owing probably to the bad weather. The election makes possible the Detroit Municipal Railway, to be owned and operated by the people of Detroit through their elected representatives in competition with the Detroit United Railway.

The proceeds of the $15,000,000 bond issue which has been approved will be used in financing the construction of 101 miles of new tracks and in equipping that trackage with 400 new motor cars and 150 new trailers, as well as the taking over of 55.5 miles of lines now being operated by the Detroit United Railway. The total trackage provided for the city system is 156.5 miles of north and south and crosstown lines, with two routes open to the heart of the city, one on Fort Street and one on Woodward Avenue.

As soon as Mayor Couzens was assured that the vote had been decided in favor of his plan, he appeared before the City Council and asked approval of a tentative arrangement to start immediately on the construction of the first line. This the Council granted and included the issuance of $100,000 in public utility bonds.

"Construction" Has Started

Arrangements were made with a local contractor, a permit issued by the Department of Public Works and on the day after the election digging was started for the foundation of the municipal line. Work was begun at Charlevoix Street and Connors Road on the so-called Mack-Myrtle belt line, with the intention of working eastward along Charlevoix Street to the city limits.

In a proclamation to the people, the Mayor states that the people of Detroit have won the greatest victory in the city's history in the approval of the bond issue, and have reaped the fruits of their courageous fight for the past twenty-five years. Under the whip of determined competition, the Mayor states, the Detroit United Railway must now furnish the service it has so long denied the people. The people are thanked by the Mayor for their approval of his plan and complimented for their stability and sound reason.

In studying the returns by wards the fact is revealed that the Couzens plan received the heaviest majorities in the outlying sections, where the residents have gone into the open country hoping that car service would some day be extended into their localities.

The way was paved for the present action when, in 1913, a proposed amendment to the city charter was adopted, providing for the creation of a street railway commission which was to acquire a railway.

In November, 1915, a vote was cast on the proposal to purchase the city properties of the Detroit United Railway at a price to be determined by the Wayne County Circuit Judges. This plan was defeated, it being generally conceded that the main objection of the voters was the fact that no fixed purchase price was named.

The last purchase plan voted on was in 1919, when Mayor Couzens submitted a proposal to take over the Detroit United Railway lines and equipment at a price agreed upon by the railway and the commission, but this was voted down by the people as the price named was believed to be far in excess of the value of the system.

To Mayor Couzens, who did not approve of the Tayler service-at-cost plan, there appeared to be no other recourse but to submit the plan of building a city system and taking over the lines which have been operated by the Detroit United Railway on the day-to-day agreement.

Taking over the Fort Street and Woodward Avenue lines, where franchises have expired, will not be attempted by the Mayor at this time. In consequence the present traffic arrangements will not be disturbed until the city is ready to provide cars and other equipment necessary to operate the lines.

No official statement has been issued by the Detroit United Railway as to what action will be taken next by the company. It is generally believed that further action on the proposed extension ordinance initiated by the Detroit United Railway will be deferred.

Toledo Strike Has Been Settled

New Wage Agreement Signed Immediately After Court Order—Higher Fares Already in Effect

Service was resumed on the railway lines of the Toledo Railways & Light Company, Toledo, Ohio, on April 7 by order of Federal Judge John M. Killits, after a four-day strike, started when the Council refused to grant a fare raise necessary to increase wages. The wage agreements were signed immediately after the order of the court had been entered and the new schedule of higher fares has gone into effect. The judge promised an "open court" investigation to determine "a compensatory return" for the company, which, according to company statistics, will mean a larger increase in fares. Fares are now 7 cents, with 2 cents for a transfer and three tickets for 20 cents.

The strike in Toledo was due to the failure of the City Council to ratify a strike settlement which involved a fare increase. The cars have been in operation only three months since the famous "ouster" ordinance removed them to Michigan for a month.

An improvised bus system was attempted to take care of the transportation needs of the city. The Council regulated the buses by placing them under a city transportation commissioner. The day fare was limited to 10 cents and owl service to 25 cents.

Wage Request Started New Dispute

After the "ouster" fiasco the cars were brought back to Toledo under the joint protection of the federal court and a city ordinance postponing the "ouster" till May 1. Meanwhile two commissions appointed by the federal court have been busy framing both cost-of-service and municipal ownership ordinances for a permanent settlement of the quarter-century traction fight in Toledo.

The new dispute, which caused a suspension of service, was injected into the traction tangle when car men and electrical workers demanded a wage increase of nearly 40 per cent effective on April 1. The electrical workers received a compromise increase and continued at work.

The conductors and motormen went on strike because the company was unable to meet their demands without an increase of fares. The representatives of the trainmen, the Mayor and officials of the company agreed that the men were entitled to a raise from 42, 44 and 46 cents an hour to 54, 56 and 60 cents. They also secured the advice of accountants to the effect that it was necessary to provide additional revenue to the company for such an increase. The scheme agreed upon by the conference was for a 7-cent fare, 2-cent transfer and three tickets for 20 cents. With this increase it was shown that company revenue would be reduced by $60,000 from what it was last year.

By the adverse vote of six Councilmen the measure ratifying the increases failed to be brought out of committee and at the second meeting of Council the whole railway question was ignored.

The 10-cent fare loomed after the refusal of Council to grant an increase from "6 and 2" to "7 and 2." Henry L. Doherty immediately dispatched the following letter to the Mayor:

> We wish respectfully to notify you that all of the propositions heretofore made by us to prevent a suspension of car service were automatically annulled when they were rejected by a vote of the Council.
>
> Our earnings at present are far below

that necessary to yield a fair return, and our representations that we are making still further sacrifices to prevent a suspension of car service have been verified by your investigators.

We must be released from further obligation under any offers we have heretofore made and be free to insist upon a scale of fares which will yield a compensatory return.

Mr. Doherty declared after sending the letter that he did not have a definite policy in mind for future negotiations. He left that to the citizens and the Council. He said he was determined to be bound by no good efforts of the past after "gratuitous insults" had been handed the company for its sacrifices in trying to effect a settlement.

The transportation system was badly tied up by the Easter snowstorm. Very few buses of any kind were running and only a few had registered.

The Toledo, Ottawa Beach & Northern and the Maumee Valley lines were also tied up by the strike. They are both Doherty lines and are operated by members of the same unions to which the city men belong. Other interurbans continued to operate into the city. This fact made the present strike less severe upon merchants than did the absolute ousting of all cars.

Almost coincident with the strike came the date for the filing of company objections to the cost-of-service plan drafted by the federal commission headed by W. L. Milner. A new ordinance embodying the changes which would make the original ordinance acceptable to the company was sent to the commissioners through Federal Judge Killits on April 3. Along with the ordinance went a forty-eight page typewritten copy of argument taking up the Milner ordinance in detail.

Features of New Measure

Among the outstanding provisions in the new draft upon which the commission is now working are these:

1. Scale of fares omits any maximum as foreign to the cost-plus idea.
2. A return of 8 per cent is asked on the stock rather than 7 per cent, with the bond return remaining at 6 per cent.
3. Elimination of the sliding scale of return on stock which provided a reward for efficient and economical operation.
4. No initial rate of fare is stated.
5. The company provides that the whole system of tracks and equipment shall be taken rather than any particular parts the city may desire to purchase in event the people decide for public ownership.
6. No property of the company beyond the city limits is included in the new ordinance.
7. The forfeiture clause of the city charter is included, but provision is made that the company is not bound by it if it should at any time be declared unconstitutional.
8. The Acme Power Company is eliminated as a party to the contract. The Acme company is a Doherty power plant which merely manufactures power and sells to the Toledo Railways & Light Company.
9. The depreciation fund is changed in name to betterment fund and its functions are outlined more clearly, as being for the purpose of maintaining the capital value at the fixed mark.
10. Lease of lines by the city must be approved by referendum and be upon six months' notice to the company.
11. The company is required to raise $1,900,000 within ninety days after the grant is accepted, $1,000,000 is for new lines and reserving $500,000 for the betterment fund, $400,000 for the stabilizing fund.
12. Regulations for contracts with interurbans are changed, giving company reciprocal rights with interurban as to examination of books and arbitration regulations.

The commission will attempt to work over the two drafts into an acceptable one so that a referendum vote may be taken about the middle of June.

The advocates of municipal ownership plan have not yet submitted an ordinance. They have asked Mr. Doherty for a cash price.

Hydro Commission Takes Over Border Lines

Detroit United Canadian Lines Taken Over by Cities After Unfortunate Experiences

The Sandwich, Windsor & Amherstburg Railway, a subsidiary of the Detroit United Railway, serving Windsor and seven other border municipalities in Canada, became the Border Cities Railway on April 1 when it was taken over by the Ontario Hydro-Electric Power Commission, culminating negotiations that have been pending for some time. The transfer was made without ceremony. The first car out of the carhouse in the morning was in charge of the newly appointed manager and the only apparent evidence of the change in service was the presence of the new tickets issued by the commission.

Arthur McGill, former engineer and assistant superintendent of the Niagara, St. Catharines & Toronto Railway, has been appointed by Sir Adam Beck, chairman of the commission, to fill the position of general manager of the lines, which will now be operated by the commission.

Howard Brooker has been appointed superintendent of the border municipal lines. He was dispatcher of the Niagara, St. Catharines & Toronto Railway.

Agitation for the taking over of the lines by the municipalities was begun by the Windsor Council members in 1918, but at that time the commission could not entertain the project. Negotiations between the officials of the railway and Sir Adam Beck were started early in 1919.

With these negotiations pending, matters came to a climax last May when the employees on the Sandwich, Windsor & Amherstburg Railway asked for increased wages. The company maintained that the increase could not be granted without a higher rate of fare, a straight 5-cent fare with a 1-cent charge for transfer being asked to replace the six-for-a-quarter fares with free transfers. The men sought to enforce their demands by a strike. This strike lasted about two weeks. It was ended by a compromise, after the railway had made an unsuccessful attempt to resume service by the aid of strike breakers, an attempt which resulted in the necessity for calling troops to maintain order.

The Ontario Railway and Municipal Board was called upon to decide the matter of fares and wages and the board, acting upon the findings of the auditors who examined the financial status of the company, recommended the wage increase demanded by the men and the 5-cent fare asked by the company.

At the election on July 5 a proposed by-law allowing the fare increase was defeated by a large majority of Windsor and Walkerville voters, and another strike resulted immediately.

The Railway Board was asked to take charge of the situation. The company was notified to resume service and when it failed to do so the board seized the lines. A settlement was soon effected and the supervision of the lines was turned back to the company, results of an audit previously made by the Railway Board having shown that the company could afford to pay its men a reasonable increase.

Large Majority for Public Ownership

On Dec. 6, 1919, a special election in the border district resulted in a large majority in favor of the Hydro-Electric Commission's plan to purchase the lines and equipment and improve the system at a total cost of $2,100,000, approximately one-third less than the company first asked. To finance the purchase, the commission was authorized to issue forty-year bonds guaranteed by the municipalities served by the lines. All expenses, both original cost and maintenance charges, will be met by the earnings of the lines and paid by the riders.

The electric light and power plant was taken over by the city of Windsor for $190,000, and will be operated as at present, using steam furnished by the Canadian Salt Company. This power will be used by the Hydro Commission to operate the cars and furnish light and power in Windsor until replaced by power from the Niagara development at Chippewa Falls.

Municipalities Plan Extensions

The present plans call for an extension inland from the Detroit River to supply the rapidly growing district with service. Thirty new steel cars of the one-man type have been ordered. New equipment is being counted upon by border residents inasmuch as it has been claimed that no repairs or replacements were made by the Detroit United Railway since the vote to take over the lines, with the result that many of the cars are now dangerous to ride in.

No increase in the six-for-a-quarter fare is contemplated. The commission's new tickets are sold on that same basis.

Better service is promised and at the same time a warning is sounded that too much cannot be expected until new equipment can be installed, new tracks laid and schedules rearranged.

Rapid Transit Plan Muddled

Opposition Appears to Be Developing Fast to Cleveland Plan as Now Proposed

Little progress was made toward the organization of a boosting committee to take part in the campaign for the rapid transit or subway bond issue at Cleveland, Ohio, when the second meeting of business and civic organizations was held in Mayor Harry L. Davis' office on April 5. The Civic League presented a report in which it objected to the construction of a subway at this time, but the indications are that a number of other organizations will support the movement, although none of them was ready to report at this time.

C. OF C. FAVORS PROJECT

Inasmuch as the original movement in favor of subways under the Public Square came from the public utilities committee of the Chamber of Commerce, Attorney A. A. Stearns, chairman of this committee, expressed the opinion that a majority of the members will favor the plan. The committee's report was scheduled for completion on April 8. In speaking of the suggestion that economy would dictate a delay in the construction of the subway, Mr. Stearns said that this alternative might prove the worst kind of economy in the end.

The recommendations made by the Civic League are as follows:

1. That the present subway proposal be voted down.
2. That the Rapid Transit Commission join with other civic bodies in having legislation passed which will make possible a metropolitan taxing area for financing future rapid transit development.
3. That the city attempt to relieve congestion without abnormal expenditure of public money: (a) That the City Council take immediate steps to reduce vehicular congestion by passing such traffic regulations as will clear the streets for moving vehicles, particularly in rush periods. (b) That further study be given to the question of rerouting cars in the public square.
4. That the City Planning Commission's proposals for our street difficulties be adequately studied and understood before we undertake other methods of relief.
5. That if none of these alternatives proves adequate to relieve congestion, and, after recommendation No. 2 has borne fruit, that the Rapid Transit Commission present to the voters of the whole district the simple question of a through rapid transit system between the East and West Sides.

The second recommendation is to the effect that the suburban towns be required to pay a portion of the cost of the proposed improvement. The fifth is based upon this condition, but limits the service to an east and west line, which would not be of any advantage to some of the outlying corporations and of little use to others. Unless the subway system can be arranged to accommodate all portions of the city, it would hardly be supported by a majority of the voters.

CIVIC LEAGUE OBJECTS

One of the principal objections made by the Civic League, aside from the money consideration, is that the subway does not provide rapid transit. Apparently, the organization does not want to install the improvement by degrees, relieving congestion in all directions, but would prefer a finished road along one line first, others to follow as they may.

Instead of making the Public Square a terminal for all cars, the report suggests:

1. Looping back of many more cars during rush periods as suggested in the report of the engineers.
2. More cars and therefore less crowding.
3. A new routing on the Public Square loops.
4. Elimination of some of the downtown stops.

Other plans suggested for the elimination of congestion are:

1. No-parking rule in the rush hour in the downtown district, and in other congested areas such as Euclid Avenue and East Fifty-fifth Street and East 105th Street, and at East Fifty-fifth Street and St. Clair Avenue.
2. One-way streets when and where necessary.
3. Good pavement for radiating streets such as Prospect, Woodland and St. Clair Avenues, S. E., and Superior, to divert vehicular traffic bound for suburbs.
4. Progress on the opening of Carnegie Avenue, S. E., and Chester Avenue, N. E., downtown.
5. Early construction of the Huron-Lorain bridge. This, according to the engineer's report, will divert a considerable proportion of east and west vehicular and street car traffic from the Public Square.

Boston Men Will Present New Wage Schedule

At the meeting of the union held in Boston, Mass., on March 24 it was voted to raise the schedule of rates for motormen and conductors on the Boston Elevated Railway from 50 cents an hour minimum rate to 73½ cents an hour and from 60 cents an hour, the present maximum rate, to 95 cents an hour.

This schedule, adopted without dissent, is to be presented to the trustees of the Boston Elevated Railway for consideration at an early date to go into effect as soon as possible at the expiration of the present agreement. This latter expires on April 30.

The new schedule, if approved by the trustees, would increase the annual payroll from $7,725,000 to $12,225,000, not taking into account any increase for other classes of labor employed on the system.

The presentation of a sliding rate in reality has no appreciable effect on the total proposed increase as practically all the motormen and conductors now in the employ of the company have been connected with the Boston elevated system long enough to receive the benefit of the maximum rate. Hence the advance from 60 cents to 95 cents an hour would affect the majority of the motormen and conductors and would amount to asking for an increase in rates of more than 50 per cent.

The prospect of wiping out the deficit of $752,342 from the operation of the system under the present arrangements, which appeared very probable by July 1, disappears in view of this new demand on the part of the union.

Ohio Men Demand Increase

Trainmen on Four Roads Present Scales Which in One Case Aggregate 100 Per Cent Rise

Platform employees of a number of electric railways in Ohio are demanding material increases in wages. In most cases, if these demands are granted, an increase in the rate of fare will be necessary to cover them. This means complications, similar to that in Toledo, where the men struck on April 2 because the City Council refused an increase of fare that would enable the railway to pay wages demanded by the men.

CLEVELAND MEN WANT 90 CENTS

In Cleveland the officers of the local union announced on March 31 that the men had voted unanimously to demand 90 cents an hour. This rate would apply to all, experienced and inexperienced alike. The new Cleveland rate demanded is an increase of 50 per cent over the highest rate in the present schedule, which is graded from 55 cents to 60 cents. In addition to the increased wage, the men demand time and one-half for all time over eight hours a day. A minimum of eight hours is thus demanded to replace the present minimum of five hours. The men further want a rearrangement of schedules to permit 60 per cent of the runs to be completed in eight hours, 30 per cent in ten hours and 10 per cent in twelve and one-half hours.

About two-thirds of the operating employees now work ten hours or more, the other third, consisting of trippers largely, working shorter time. If the demand is granted the company's payroll would be increased between 55 and 70 per cent, according to one of the officials, and it would probably be necessary to increase the rate of fare from 5 cents to 6 cents.

At Youngstown Mayor Fred Wornock offered his services as mediator when the Ohio-Pennsylvania Electric Company and its platform men disagreed on a new wage scale. He thereby prevented a strike planned for March 31. The men are demanding 70, 73 and 75 cents an hour. The company offered to pay 60, 63 and 65 cents. The present scale is 40, 43 and 45 cents. A conference with the union is awaited.

AKRON MEN WANT 80 CENTS

Platform employees of the Northern Ohio Traction & Light Company on the local lines at Akron are asking for a wage of 80 cents an hour, with an eight-hour day and pay for ten hours. Negotiations will be taken up within a few days, it was announced by union officials. It is said that employees at Canton are also asking for increased wages.

It is reported that employees of the Cleveland, Southwestern & Columbus Railway at Elyria are preparing to ask for a new wage scale, with $1 an hour as the maximum. The present scale is 42, 46 and 50 cents.

Bills Introduced in New York

A Summary Is Presented of Important Recent Bills, Except the Service-at-Cost Measures

Among the bills affecting the electric railways introduced in the New York State Legislature recently are the following:

Senate Intro. No. 913, Print No. 1019. Introduced March 9, by G. F. Thompson. Amending section 178 railroad law by providing that street surface railroad companies shall keep in permanent repair that part of streets 6 in. in width on each side of rails instead of all the space between its tracks and 2 ft. outside as at present required.

Senate Intro. No. 991, Print No. 1116. Introduced March 11 by Mr Gibbs. Amending section 66 public service commissions law by providing for suspension of rates of gas and electric corporations for a period not longer than 120 days pending determination by the Public Service Commission.

Assembly Intro. No. 1056, Print No. 1176. Introduced March 9 by Mr. Amos. Adding new section 27-a public service commissions law by providing that no corporation shall charge for transportation of passengers a rate of fare in excess of that specified in its charter, such rate to be a maximum rate until the corporation applies to public service commission for permission to increase same. The commission is empowered to allow such increase provided it is fair and reasonable and in the public interest. The act takes effect Sept. 1, 1919, the date on which the Government control measure becomes inoperative.

Senate Intro. No. 1150, Print No. 1321. Introduced March 18 by Mr. Marshall. Amending section 239 banking law, relative to investment by savings banks in bonds of street railroad companies.

Assembly Intro. No. 1268, Print No. 1431. Introduced March 15 by Mr. Bloomfield. Amending section 47 public service commissions law, by providing that the first district commission shall report not less than one and the second district commission not less than two accident inspectors, whose salaries shall be fixed by the commission.

Assembly Intro. No. 1313, Print No. 1515. Introduced March 17 by Mr Healey. Requiring the giving of transfers by surface railroads whose tracks run in southerly or northerly direction for a continuous trip on intersecting lines in Manhattan and Bronx, New York City.

Assembly Intro. No. 1338, Print No. 1540. Introduced March 17 by Mr Soule. Amending section 53-a railroad law, by placing the jurisdiction of the location and character of crossing signs under the Public Service Commission and striking out the present arbitrary language of the section.

Assembly Intro. No. 1439, Print No. 1660. Introduced March 19 by Mr. Trahan. Adding new section 63-a railroad law by requiring an additional motorman on electric trains of two or more cars.

Assembly Intro. No. 1441, Print No. 1662. Introduced March 19 by Mr. Webb, enacting the public service contract law, to be chapter 72 Consolidated Laws, providing for service contracts of employment between public utilities corporations and their employees and for the enforcement thereof. Such contracts are to be filed in the office of the Public Service Commission. There is provision for a fund for payment of fines imposed on corporations or employees. The Public Service Commission is to appoint boards of award to adjudicate claims arising under service contracts. Service of a public utility is not to be interrupted. There are provisions for injunctions and damages.

Senate Intro. No. 1464, Print No. 1721. Introduced April 1 by Mr Lynch. Amending sections 242 and 595 greater New York charter, relative to design, construction, purchase and operation of omnibuses in New York City. The comptroller with the approval of the board of estimate and apportionment, is authorized to issue special revenue bonds to meet expenses of maintenance and operation during 1920 of municipal omnibuses.

Assembly Intro. No. 1613, Print No. 1935. Introduced March 31 by Mr. Martin. Amending section 240 village law by permitting lighting contracts at an expense not exceeding 5 mills instead of 2½ mills as at present on every dollar of taxable property.

Assembly Intro. No. 1593, Print No. 1915. Introduced March 31 by Mr. Amos. Amending section 20 transportation corporations law, relative to incorporation of stage coach companies by increasing from five to nine the maximum number of directors.

Suggests Service at Cost for Indianapolis

The Public Service Commission of Indiana on March 30 called a conference of the officials of the Indianapolis Street Railway and of the city of Indianapolis for the purpose of considering the establishment of a "service-at-cost" plan of railway operation. It is hoped by this means to place the company on a sounder financial basis, enable it to earn sufficient revenue to pay a fair return on invested capital and establish credit to provide sufficient funds for the purchase of additional cars and equipment.

The officers of the railway expressed their favor of such a plan. The Corporation Counsel of the city of Indianapolis stated that in the past the city had taken the position that the Public Service Commission did not have jurisdiction over the local company, but that the courts had decided otherwise. He said that if the company was entitled to relief when the commission issued the 5-cent fare order, it certainly was entitled to relief now, as prices have not declined (as was anticipated by the commission when the order was issued over a year ago) and the emergency still exists. In speaking for the city, he said it was essential the company obtain more cars to keep pace with the city's growth.

E. I. Lewis, chairman of the commission, remarked that during the last two years there has been a marked change in the attitude of the public and the city toward the company.

Pittsburgh Men Want Still More

The motormen and conductors of the Pittsburgh (Pa.) Railways on March 29 presented demands to the receivers of the company for a wage increase of 70 to 75 per cent, an eight-hour day and time and a half for overtime, effective on May 1. The wage demands are: First three months' service, 86 cents an hour; nine months' service, 89 cents an hour, and, after the first year's service, 91 cents an hour. At the maximum rate and under the eight-hour day platform men, after one year's experience, would receive $7.28 a day. Under the existing agreement, in which the rates were fixed by the National War Labor Board, the men received 49, 52 and 54 cents an hour.

Announcement was made on April 6 that negotiations between the receivers of the Pittsburgh Railways and the trainmen would not begin until the week commencing April 11. The present wage scale of the trainmen calls for a maximum of 57 cents an hour.

The receivers issued a statement in which they deny that an increase is contemplated in the present fare of 10 cents cash or 7½ cents when buying disks. The Public Service Commission has just handed down its long awaited decision in which it holds that the present fare is legal.

The receivers say they are not making a great amount of money now, but that the increase in fare several months ago has given them sufficient revenue to keep going under the present overhead and general expenses.

On April 1 a voluntary increase of 10 per cent for all its hourly men, announced some time ago by the receivers, went into effect, making motormen's and conductors' wages 54, 57 and 60 cents an hour, but the new demands are 60 per cent, about 31 or 32 cents an hour, higher than these. The eight-hour day would succeed the present working day, which averages nine hours.

Hearing April 13 on Service-at-Cost Measure

There is to be a public hearing on April 13 before the judiciary committee of the Assembly on the following measures:

Assembly Print No. 1961, entitled: "An act to authorize cities and incorporated villages and towns of the state to enter into agreements with street surface and rapid transit railroad corporations for transportation upon a service-at-cost plan and empowering the public service commissions, in certain cases, to order temporary or permanent changes in the rates, fares and charges of such corporations."

Assembly Print No. 1962, entitled: "An act to amend the public service commissions law, in relation to liability for violations of chapter."

Assembly Print No. 1963, entitled: "An act to amend the public service commissions law, in relation to transportation rates, fares or charges."

These three measures were introduced on April 1 by Assemblyman Edmund B. Jenks of Broome County and are companion bills covering the service-at-cost plan of operating street surface railroads. It is the consensus of opinion that the measures have more than an ordinary show of passage, especially as the judiciary committee of the Assembly voluntarily set the date for the hearing on the measures. The bills have not as yet been introduced in the Senate, but if the action of the Assembly on them be favorable there is little doubt of their passage.

The opposition to the measures is expected to come principally from those members who are opposed to conferring upon the Public Service Commission arbitrary franchise-giving powers now vested in the Legislature itself as a constitutional right and from those members of the Legislature who are fearful that the immediate result of the passage of the bills would be to raise the rate of fare paid in New York City. It is anticipated that the hearing on the bills will be largely attended. Already the interest in the bills has caused the printed supply to become exhausted, but it is hoped to have additional copies printed in time for the hearing.

Receiver Seeks $2,000,000 for Reconstruction

Rolla Wells, receiver of the United Railways, St. Louis, Mo., is seeking permission to spend $2,000,000 for the purchase of about 160 new cars, $917,380 for track reconstruction within the city and $140,200 for track reconstruction on the St. Charles line in St. Louis County. A hearing on the merits of the application of the receiver for permission to make these expenditures was begun on March 30 by Special Master Henry Lamm. Albert T. Perkins, manager for the receiver, stated that he desired to rebuild about 31 miles of city tracks. Henry S. Priest said that some track reconstruction was necessary, but that in view of the present high prices only such work should be done as was absolutely essential. He and Richard McCulloch, president of the company, had fixed 25 miles as the amount of reconstruction to be carried forward at this time. It was planned to do this work gradually.

Anti-Strike Bill in Massachusetts

A bill to prevent strikes on the electric railways in Massachusetts now owned or controlled by the State is before the Legislature. The measure is identical with the recommendations of the special committee on street railways brought before the special session last November. Briefly it provides for continuity of service on all publicly owned or controlled lines, making it unlawful for any agents, officers or persons in the service of the companies to prevent the continuous operation of the lines.

The bill further provides for the arbitration of differences of opinion or disputes regarding compensation, hours of labor or working hours and proposes the establishment of a board for this purpose.

The penalty for violation of the provisions of the bill is discharge from the service of the company in which the violator works and the prevention of re-employment of the offender by the railway company for a period of one year.

Carhouse and Cars Destroyed

Fire destroyed the storage carhouse of the International Railway, Buffalo, N. Y., in the Riverway, Niagara Falls, N. Y., on March 21 with a loss of eight passenger cars, three snowplows and a sweeper. The loss is estimated at $60,000. The cars were of an old type and were used during the rush hour periods on the local lines. The storage carhouse was formerly a roller skating rink. It adjoined the Riverway terminal of the Niagara Falls interurban lines. The main terminal was not damaged by the fire. The company proposes to enlarge the terminal by erecting a new building on the site of the storage sheds that were burned.

News Notes

Jitney Regulatory Bill Passed.—The bill giving the Board of Public Utility Commissioners jurisdiction over the jitneys in New Jersey has been passed by the Legislature.

Retroactive Pay Award—Employees of the Western New York & Pennsylvania Traction Company, Olean, N. Y., have been granted a wage increase retroactive to Oct. 18, the date when the lines of the system were tied up by a general strike. The men will receive an advance of 5 cents an hour, making the new scale from 32 to 38 cents an hour.

I. T. S. Not Seriously Damaged.—The property of the Illinois Traction System, Peoria, Ill., was not seriously damaged by the recent hurricane. A total of 150 poles was blown over by the high winds of March 25 and trains were delayed from three to five hours during the day and the following night. The worst breaks were north of Lincoln, Ill.

May Change Its Voltage.—The British Columbia Electric Railway, Vancouver, B. C., is thinking of changing the voltage on the Fraser Valley line from 600 to 1,200 volts to help get freight trains over the grade. The lengthening of freight sidings is also contemplated in order to take care of the long trains which are now being handled on the line.

Wage Hearings Postponed.—Action on the demands of the employees of the New York State Railways, Rochester, N. Y., for increases in wages has been postponed. A meeting is scheduled for the week commencing April 11. As explained in the ELECTRIC RAILWAY JOURNAL for April 3, page 720, the men are seeking an advance of 100 per cent.

Wages Raised by West Penn Company.—A wage increase of approximately 10 per cent has been granted by the West Penn Railways, Pittsburgh, Pa., to all trainmen and shopmen, effective immediately. About 600 men are affected. The advance makes the rate for trainmen 55, 58 and 60 cents an hour, the top figure being paid to employees after one year's continuous service. The old rate was 50, 53 and 55 cents an hour.

Worcester Men Want More.—The carmen's union of the Worcester (Mass.) Consolidated Street Railway have presented to Clark V. Wood, president of the company, a demand for an eight-hour day for all conductors and motormen, a 40-per cent increase in wages for all miscellaneous employees and $6.40 for an eight-hour day for all uniformed men operating two-men cars and 15 cents an hour above the regular schedule for all men operating one-man cars. They call for $5.20 a day for beginners for the first three months of service and $5.30 a day for the remaining nine months of the first year, pay thereafter to be $6.40. The employees of the Springfield (Mass.) Street Railway have presented similar demands to the officials of that road. Their present contract with the company will expire on June 1.

Programs of Meetings

Arkansas Utilities Association

The convention of the Arkansas Utilities Association will be held at the Arlington Hotel, Hot Springs, Ark., on April 26, 27 and 28.

Central Electric Railway Accountants' Association

The next meeting of the Central Electric Railway Accountants' Association will be held at the Lincoln Hotel, Indianapolis, Ind., on April 24.

National Safety Council

The Spring conference of the Engineering Section of the National Safety Council is to be held at the Engineering Societies Building in New York City on April 27. The morning session will first take up the relationship of safety and engineering efficiency—the question whether, apart from its human values, safe operation of a factory or a railroad is in truth inseparably connected with efficient operation. The afternoon session will be devoted to safety standards: first, the present movement for uniform standards; second, the National Safety Council's part in this movement.

Chamber of Commerce of the United States

The main topic to be considered at the eighth annual meeting of the Chamber of Commerce of the United States, to be held in Atlantic City April 27-29, is "Increased Production." The delegates will consider this topic from six points of view, namely, the relation to increased production of government, transportation, international finance, research and efficiency, immigration and Russia's part. In addition, there will be group meetings of various industries. The program of the transportation meetings is as follows:

Tuesday afternoon, April 27: Report of committee on railroads, George A. Post, chairman; "Railroad Consolidation," by John E. Oldham of Boston; "Car Supply and Car Service," by Charles E. Lee, Ford, Bacon & Davis, New York.

Wednesday morning, April 28: "Transportation in Relation to Production," (a) "Railroads," by George A. Post, and one other speaker, probably a member of the Senate or House committee on railroads; (b) "Merchant Marine."

Financial and Corporate

Reorganization Terms Stated

Committee Representing Security Holders Gives Details of Security Exchange Following Wheeling Sale

A reorganization plan has been announced for the West Virginia Traction & Electric Company, Wheeling, W. Va., the property of which was sold recently under foreclosure as noted previously in the ELECTRIC RAILWAY JOURNAL.

TWO NEW COMPANIES

It is proposed by the committee in charge of the reorganization to create two new companies. One of these companies will be known as the Wheeling Company. To it will be transferred the Wheeling-Elm Grove properties subject to existing underlying liens. The other company will be known as the Morgantown Company. To it will be transferred the Morgantown properties subject to the Union Utilities lien, under which bonds of $874,000 are outstanding. There will also be transferred to the Morgantown Company the stock of the Wheeling Company and all the two-year notes represented by the committee, together with all of the outstanding bonds of the old company, the deficiency claims, etc.

The proposed Morgantown Company will be organized with a total authorized common capital stock of $1,000,000, of which the present issue will be $500,000. No dividend is to be paid on this stock for two years and the net income for that period is to be carried to surplus. Moreover, not more than one-half the sum which subsequently becomes available for dividends is to be paid as such. The balance is to be carried to surplus with protective provisions for maintenance and depreciation.

There will also be a total authorized issue of $1,500,000 of 7 per cent cumulative preferred stock by this company. Of this amount $862,733 is to be issued at present. The cumulative preferred stock is to have equal voting power, share for share, with the common stock. It is to be preferred both as to dividends and assets and is to be redeemable at the option of the company, all or in part, from time to time at 105 and dividend.

DETAILS OF SECURITY EXCHANGE

Ahead of both issues of stock will come an authorized issue of $5,000,000 for fifteen-year 6 per cent general mortgage bonds. Of this issue $1,136,400 will be issued at this time. These general mortgage bonds will constitute a second lien upon the Morgantown properties and a first lien upon the stock of the Wheeling Company. The securities received by the committee will be distributed as follows:

1. To the committee for the account of the noteholders in the sum of $1,800,000 face value: (a) Bonds in 60 per cent of face of defaulted notes, $1,080,000; (b) preferred stock, 40 per cent of face of defaulted notes, $720,000; (c) preferred stock for interest at 6 per cent of the defaulted notes from May 1, 1919, to Jan. 1, 1920, $72,000.

Upon consummation of the plans, therefore, the holders of the notes deposited will receive for each $1,000 note, $600 in bonds and $400 in preferred stock of the new company, with $40 of additional preferred stock for account of the accrued interest from May 1, 1919, to Jan. 1, 1920.

2. To holders of the outstanding $94,000 of bonds of the West Virginia Traction & Electric Company. (a) Bonds in 60 per cent of face value of bonds of the old company, $56,400; (b) preferred stock in 40 per cent of face of bonds of the old company, $37,600; (c) preferred stock for interest on bonds of the old company from May 1, 1919, to Jan. 1, 1920, $3,133.

(3) To bankers in consideration for $30,000 in cash, for underwriting $10,000 of the new securities, for the loan of $40,000 to the committee, for the assignment of $591,098 of proved claims in the receivership representing cash advances to the owners of the company: (a) preferred stock, $30,000; (b) common stock, $500,000.

DIVIDENDS LIKELY FROM START

The receiver estimates that the operating income of the Morgantown property alone for the year 1920 after providing for normal maintenance, but before reserve for the depreciation and after deducting from earnings all expenses for new drillings will be well over twice the interest on the bonds of the new company and the outstanding bonds of the Union Utilities Company, and that, after paying interest charges on these bonds, the balance will be approximately three times the sum required to pay dividends on the preferred stock. It is probable that the company will be able to begin paying dividends on its preferred stock at once. These estimates the committee seems to be reliable, but it does not guarantee their correctness.

$1,500,000 for Chicago

The city of Chicago will receive nearly $1,500,000 as its share of the earnings of the local railways for last year. This is more than two and a half times the city's share for the previous year. Under the contract ordinance by which the city gets 55 per cent of the net earnings of the companies $1,005,259 will be derived from the Chicago Railways and $443,588 from the Chicago City Railway

Municipal Line Going Behind

San Francisco Has a Deficit or Not, Depending Upon the Shade of Observer's Glasses

The San Francisco (Cal.) Municipal Railway has reported for January. Actually the road is making money; theoretically it is losing money. Or theoretically the road is making money; actually it is losing money. It all depends. Those who favor municipal ownership see the matter one way; those who oppose it see the matter another. The receipts for January were $229,030. The expenditures were $180,711. Thus the excess of receipts over expenditures appears to be $48,319. But against this amount of $48,319 there remain to be charged up depreciation of $40,974, or 18 per cent of the gross passenger revenue, interest of $19,458 on outstanding debts and $2,410 for injury insurance. Thus the apparent surplus of $48,319 becomes a deficit of $14,524.

Supervisor Ralph McLeran, chairman of the finance committee, says the idea of increasing fares has not been discussed seriously. He is quoted as follows:

> The lines are being operated at a profit. The gain is in the 18 per cent depreciation fund, which takes care of all the deficits in the operations fund and leaves a surplus besides. It is claimed by some that 18 per cent is excessive, but from what we have gathered it is not advisable to change the method at this time. It will not be long before the city is taking other traction arteries and then other methods of maintaining the funds may be decided upon.

Paving Very Burdensome

Setting forth several paving projects in Atlanta, Ga., this year that will cost the Georgia Railway & Power Company more than $200,000, the current issue of *Two Bells*, published by the company for general distribution, explains one of the principal items of overhead expense the company, or any other railway, has to contend with. It shows very clearly why it is so difficult to develop railway service into a paying proposition.

Under the charter of the city of Atlanta the company is assessed for a width of 16 ft. on all paving or repaving done where it has double tracks and 11 ft. where it has single tracks. This assessment is, in reality, a forced contribution, the company points out, because every kind of a vehicle uses the streets. During the recent strike the public was impressed by the great volume of the traffic.

The repaving of Juniper Street recently cost the company $25,204. This single item required 420,077 6-cent fares to pay for it, and this is but one small item of the paving expense the company is required to meet. On this particular assessment the company petitioned the Railroad Commission for authority to pay it one-fourth cash and the rest on promissory notes because of the company's financial condition. Furthermore the company has asked the same privilege in paying future assessments for paving or repaving.

Milwaukee Income Increases

Income Statement Indicates Property in Fair Financial Condition—Bulk of Revenue from Railway

The recently issued annual report of the Milwaukee Electric Railway & Light Company for the year ended Dec. 31, 1919, shows operating revenues of $14,888,446, an increase over 1918 of $2,878,175, or 23.96 per cent. The railway department earned $8,273,989, or 56.6 per cent of this amount. Operating expenses, including taxes and reserves, amounted to $11,552,374, an increase of $1,987,751, or 20.78 per cent, leaving $3,336,072 as the net operating revenue. Non-operating revenues were $145,539. Interest charges, including interest on depreciation reserve balances, totaled $2,016,343, leaving a net income for the year of $1,421,269. Gross income available for payment of interest and dividends was $3,481,612.

In February, 1919, the Milwaukee Electric Railway & Light Company acquired and now operates the property of the Milwaukee Light, Heat & Traction Company, comprising an extensive system of suburban and interurban railways within a radius of about fifty miles of Milwaukee, the local railway system in Racine and the electric power transmission and distribution system throughout the territory served by the suburban and interurban railway lines.

The earnings and expenses of the Milwaukee Electric Railway & Light Company as reported above for the year 1919 accordingly include those of the property formerly owned by the Milwaukee Light, Heat & Traction Company. For the purposes of comparison the earnings and expenses of both companies for the year 1918 have been combined.

The operating revenue of the railway utility was $1,669,650, or 25.28 per cent, more than during 1918. This is attributed partly to the effect of the discontinuance on June 1, 1918, of the sale of reduced rate tickets in the single fare area and an increase effective on Nov. 2, 1919, in the fare in the Milwaukee single fare area and partly to increased zone fares on the suburban and interurban lines which became effective in July, 1918, and on Nov. 2, 1919. The traffic has increased to a marked extent. Expenditures during the year for additions, extensions and betterment to the plants and systems of the railway amounted to $289,086, equivalent to 20.5 per cent of the total of $1,4410,384 for property additions.

Four quarterly dividends, each of 1.5 per cent, were declared during the year on the $4,500,000 of outstanding preferred stock. In the railway department 25.6 per cent of the operating revenues was appropriated for maintenance and depreciation. Any balance of this appropriation remaining after providing for maintenance was carried to the credit of the depreciation reserve, which at the close of the year amounted to $3,595,781.

Following the statement by the company of its inability to meet the request of its trainmen for an increase in wages and earn a fair return on the capital invested in its railway utility property, an investigation was undertaken upon request of the company by the Board of Conciliation appointed under a new Wisconsin law. The findings of the Board of Conciliation disclosed the necessity of an increase in the trainmen's wages. These findings, under which the trainmen were awarded an increase of nine cents per hour, were referred to the Railroad Commission of Wisconsin. The commission issued an order increasing the rate of cash fare in the single fare area from 5 cents to 7 cents and providing for the sale of tickets at six for 35 cents and eighteen tickets for $1, and directed the company to thereupon make effective the increase in wages awarded by the Board of Conciliation. The order of the commission affecting both wages and fares became effective on Nov. 2, 1919.

The accompanying tables pertain entirely to the operation of the railway department and indicate that the recent fare increases have had a marked effect on increasing the revenues from transportation.

MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY
(Railway Operations Only)

Income Statement		1919	1918	Per Cent Change Inc—Dec.
Revenue from transportation		$8,041,458	$6,436,169	+ 24.10
Revenue from other railway operations		232,531	177,358	+ 31.10
Total railway operating revenue		$8,273,989	$6,613,527	+25 20
Maintenance and depreciation appropriation (25.76 per cent. operating revenue)		2,125,000	(a)	
Additions to property		$289,086	(a)	
Roadway and track	$185,044			
Revenue cars	13,680			
Elec. eq. of rev. cars and locomotives	768			
Railway utility equipment	19,004			
Miscellaneous utility equipment	31,935			
Other expenditures	38,655			

(a) Not shown in report.

STATISTICAL STATEMENT OF MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

Owned and leased:	1919	1918	Per Cent Change + Inc.— Dec.
Total mileage	403.45	403.79	+ 0.083
Average total miles operated	381.05	380.26	+ 0.207
Car-miles (active)	20,681,252	20,014,231	+ 3.33
Car-hours (revenue)	2,165,972	2,140,300	+ 1.20
Ratio car-miles to car-hours (per cent)	9.56	9.41	+ 1.59
Revenue passengers	146,208,335	129,240,334	+ 13.10
Transfer passengers	51,287,831	46,560,391	+ 10.17
Total Passengers	197,496,166	175,800,725	+ 12,32
Ratio transfer to revenue passengers (per cent)	35.08	36.03	
Gross passenger revenue	$8,041,458	$6,436,169	+ 24.95
Average fare:			
Per revenue passengers (cents)	5.50	4.98	+ 10.42
Per total passengers (cents)	4.07	3.66	+ 11.22
Car-mile statistics:			
Operating revenue (cents)	40.01	33.00	+ 21.22
Passenger traffic (total)	9.12	8.82	+ 10.95
Car hour statistics:			
Operating revenue	3.83	3.09	+ 23.62
Passenger traffic (total)	95.4	87.80	+ 8.77
Mileage statistics:			
Gross passenger revenue per mile of track operated	$21,100	$16,910	+ 24.75

Fort Scott Road Scrapped

The railway portion of the property of the Fort Scott Gas & Electric Company, Fort Scott, Kan., about 9 miles, has been abandoned and dismantled and the rails are being torn up. The other divisions are to be continued as the Fort Scott Public Utilities Company.

The troubles of the railway at Fort Scott date back to 1918. Early in that year receivership proceedings started. Even that early the railway in Fort Scott sought relief from municipal restrictions as a way out. Conferences looking toward that end were arranged, but proved unavailing. In April of that year the company reported operation had been discontinued.

Operating Managers for Ohio Electric Railway

Day & Zimmerman, Philadelphia, Pa., have taken over the Ohio Electric Railway, Springfield, Ohio, as operating managers. They will conduct the property in the interest of Drexel & Company, Philadelphia, and the bondholders' protective committee. Interest is understood to be in default on certain bonds of the company secured with the bankers by pledge of stock as collateral. Rather than foreclose, the bankers enter the active management of the company, through Day & Zimmerman, in complete understanding with W. Kesley Schoepf, president of the company, and the interests which he represents.

F. A. Healy, secretary and treasurer of the Ohio Electric Railway, attributes the present unsatisfactory financial condition of the company to the increased cost of operating the road in comparison with increases in revenue. This, he said, is due to the high cost of labor, the taxes which the company is forced to pay on its holdings and the vast amount of paving which the railway has been forced to do.

$6,000,000 Equipment Trust Proposed

In submitting the ordinance giving approval of City Council to the issuance of $6,000,000 of equipment trust certificates by the Philadelphia (Pa.) Rapid Transit Company, W. C. Dunbar, vice-president of the company, stated that the notes would bear interest at the rate of 6 per cent per annum, maturing in equal semi-annual instalments during a period of not more than ten years and secured by the lease of 1,500 surface and 97 elevated-subway cars. Mr. Dunbar said:

This proposed equipment trust certificate issue is required to finance immediate necessities and supply increased car carrying capacity. The financing of new lines and extensions is planned to be accomplished by the formation of new companies issuing first mortgage bonds to cover the cost of construction, to be guaranteed by P. R. T., which company will also be the sole owner of such nominal issue of capital stock as may be required. Plans for the issuance and sales of these bonds will be presented from time to time, for your approval.

It is pointed out in the letter that the sum of $2,400,000 is urgently required to meet immediate necessities, covering reconstruction of 20 miles of track, power plant and sub-station improvements; modernizing 700 cars, and for additional shop facilities.

Demand Made for Forfeiture of Charters

Arguments in the quo warranto proceedings brought by David I. McCahill, Pittsburgh, Pa., for forfeiture of the charters of twenty-one district electric light and power companies in Beaver, Lawrence and Butler Counties are being heard by Attorney-General William I. Shaffer of Pennsylvania. The companies are held by the Mahoning & Shenango Railway & Light Company, the Pennsylvania Power Company, the New Castle Electric Company and the Zelienople Electric Company.

It is contended by Mr. McCahill that none of the companies has started construction work or made effort to show existence as operating concerns during two years following incorporation. Plans of works of competing companies are being gone over and efforts being made to establish physical existence of the companies involved. Among those who appeared against the concerns were Lieutenant-Governor Beidleman, David I. McCahill, H. Etheridge, H. J. Van Buren and Clyde Ferris. Banking Commissioner John S. Fisher, Ralph E. Baker and T. E. Coleman appeared for the companies.

Key Route Holders Respond to Call for Deposits

With respect to the proposed reorganization of the San Francisco-Oakland Terminal Railways, Oakland, Cal., it is stated that no definite plan of reorganization has been decided upon, but that under the suggestion of the State Railroad Commission of California it has been deemed advisable to ask for the deposits by the various bond and note holders, partly for assisting in the reorganization and partly for the purpose of learning to what extent the various security holders appreciate the necessity of action to conserve their various interests.

The reorganization committee is said to have received approximately $6,500,000 of the $20,000,000 of bonds of the company, representing some eighteen different issues.

It was explained by the members of the reorganization committee last December that since 1916, the East Bay communities had been giving serious consideration to the question of a resettlement franchise for the company. The voters have passed an enabling act and have taken initial steps for the submission of the franchise question to the people for final decision. In this connection, the Railroad Commission, with the co-operation of the municipalities and the company, is engaged in placing a valuation upon the company's property.

Municipal Railway Operation Segregated

At the instance of Hugh M. Caldwell, Mayor of Seattle, Wash., an ordinance has been passed by the City Council assuring the complete segregation of the operation and maintenance of the Seattle Municipal Railway from the Department of Public Utilities. The ordinance as passed creates a department to be known as the Division of Municipal Railways, to be under the direction of a general superintendent.

As heretofore reported, David W. Henderson has been appointed to this position. The ordinance provides that the operation of the municipal railway, including cars and trains, carhouses and shops, and the maintenance of way and structures be placed in an administrative section of the Department of Public Utilities, to be known as Division of Municipal Railways.

Need $6,625,000 for Repairs

New York City's surface lines need about $6,625,000 to put their tracks, cars and other equipment in first-class operating condition, according to testimony of witnesses at a recent hearing before the Public Service Commission for the First District. In some instances the deferred maintenance charge covers paving along the right-of-way, which some of the roads in the hands of receivers have frankly stated their inability to repair.

Paving repairs are being made by the city, and the cost charged against the companies, to be later liquidated. In some cases the testimony showed that the cars of several companies need repairs to the extent of from $500 to $1,000 each. Cars, tracks and equipment generally, it was stated, however, are at the present time in safe operating condition, but if repairs are much longer neglected the margin of safety will be decreased.

Financial News Notes

New Director at Charleston.—W. King McDowell has been elected a director of the Charleston Consolidated Railway, Gas & Electric Company, Charleston, S. C., to succeed William M. Bird, deceased.

Three-Year Notes Called for Payment.—The Empire State Railroad Corporation, New York, N. Y., has elected to call for payment on May 1 all of its three-year 6 per cent mortgage notes then outstanding.

Bond Issue Approved.—The Department of Public Utilities of Massachusetts has approved an issue of $500,000 twenty-year 5 per cent mortgage bonds by the Middlesex & Boston Street Railway to refund a similar amount of 4½ per cent bonds maturing April 1, 1920.

Two-Year Notes Offered.—Bonbright & Company, New York, N. Y., are heading a syndicate which is offering $2,000,000 of two-year 7 per cent gold notes of the United Light & Railways Company, Grand Rapids, Mich. The notes are dated April 1, 1922. They are being offered at a price to yield more than 8 per cent.

Hyde Park Line Continued.—The Public Trustees of the Eastern Massachusetts Street Railway, Boston, Mass., on March 28 announced the continuance of service in the Hyde Park district. Plans are being devised for the installation of one-man cars and the purchase of electricity for this district, thereby shutting down the Hyde Park power house. The terms of operation remain to be fixed.

Manufacturer Offers to Buy Road.—As a solution of the higher fare controversy in Poughkeepsie, Norman Milliken, head of the Mohawk Plow Works in that city, has offered to buy out the Poughkeepsie & Wappingers Falls Railroad at its appraised valuation. The railroad, which is now charging a 6-cent fare, has an application pending for an increase to 8 cents, but thus far the city officials have refused this concession.

Tide Water Stock Offered.—The First National Trust Company, Durham, N. C., and Durfey & Marr, Raleigh, N. C., recently offered for subscription 7 per cent cumulative preferred stock of the Tide Water Power Company, Wilmington, N. C. The proceeds from the sale of the preferred stock will be used to liquidate current liabilities, retire $350,000 of bonds and to make betterments and additions to plant. Included in the company's properties are the railway lines in Wilmington.

Interest Payment Arranged.—J. D. O'Keefe, receiver of the New Orleans Railway & Light Company, New Or-

leans, La., notified holders of the 4½ per cent general mortgage bonds of that company that the coupons due on Jan. 1, 1920, would be paid on March 30 upon presentation at the office of the New York Trust Company, or at the Hibernia Bank & Trust Company, New Orleans. In addition to the coupons, 26 cents per coupon representing interest thereon was paid.

New Bond Issue for Massachusetts Road.—The Middlesex & Boston Street Railway has been authorized to issue twenty-year bonds to the value of $500,000 to bear interest at a rate not exceeding 4½ per cent. These bonds will be used for paying and refunding a $500,000 issue of the Lexington & Boston Street Railway which expired on April 1, 1920.

Discharge of Receiver Expected Soon.—It is reported from Binghamton, N. Y., that Receiver W. G. Phelps of the Binghamton Railway and his attorney, Thomas J. Keenan, of Curtiss, Keenan, Brink & Harrison, are making all needed legal preparations for paying off, within the next six months, $400,000 in outstanding debts and obligations against the company, and also meeting $75,000 in loans obtained by Mr. Phelps upon receiver's notes. It is expected that the receivership will be lifted in six months.

More Massachusetts Lines to Suspend.—P. F. Sheehan, manager for the Eastern Massachusetts Street Railway at Brockton, Mass., announces the Rockland-Braintree depot line will no longer be operated and that, in view of the loss of patronage, the Queen Anne's corner route will probably be discontinued, although the decision so to act will be left in the hands of the Brockton division service board at its next meeting. The decision with regard to the Rockland-Braintree line grew out of the controversy with the Weymouth town officials, who have allowed the jitneys to run again.

Readjustment of Securities Abandoned.—The stockholders of the North American Company, New York, N. Y., have abandoned the plan calling for a rearrangement of the capital stock of the company as outlined recently in the ELECTRIC RAILWAY JOURNAL. William Nelson Cromwell has been elected chairman of the board of directors of the company to succeed the late George Sheldon and Albert D. Boardman has been elected a director. The resignation of James D. Mortimer as president of the company, effective on Nov. 1, was referred to at length in the ELECTRIC RAILWAY JOURNAL for April 3.

Jersey Senate Approves Valuation Measures.—The New Jersey Senate has passed the measure of President Clarence E. Case providing for an independent appraisal of all electric railway properties in New Jersey. The Governor, State Treasurer and State Comptroller, under the provisions of the measure, are to compose a commission which will supervise the work having to do principally with the valuation of the Public Service Railway, Newark, N. J., property by expert engineers and make a report, which will form the basis for fixing fair and equitable rates of fare. An appropriation of $100,000 is provided to carry on the work.

Illinois Road Sold to Bondholders.—The Galesburg & Western Railroad, formerly the Rock Island Southern Railroad, Galesburg, Ill., has been sold for $151,000 to W. S. Hammons, Portland, Me., acting for the committee of the bondholders, said committee consisting of W. S. Hammons, Portland, Me., chairman; Frank S. Wingate, Hallowell, Me., and M. O. Williamson, Galesburg, Ill. There was one other bidder at the sale, C. C. West, said to represent Walsh Brothers, owners of the majority of the stock of the railroad. The sale to Mr. Hammons will now go before the Circuit Court of Knox County for confirmation by Judge Thompson.

Recommends Bonds Be Extended.—At the hearing in St. Louis, Mo., on March 30 before Special Master Henry Lamm to inquire into reconstruction work to be carried out by the United Railways, St. Louis, Judge Lamm took up in informal discussion the question of the means to be adopted to meet the bonds of the St. Louis Railway, an underlying company of the United Railways, when they fall due on May 1. Henry S. Priest suggested that it might be well to seek the consent of the holders of the bonds to an extension of them at a higher rate of interest rather than to issue receiver certificates to refund the bonds. Judge Lamm said that he thought well of this plan. He recommended it to the receiver.

More Time Allowed for Shore Line Report.—In the case of Old Colony Trust Company, Boston, Mass., vs. the Shore Line Electric Railway, Norwich, Conn., Judge Kellogg has granted Receiver Robert W. Perkins until May 15 to file his semi-annual statement. Ordinarily it should be filed by April 5, but Attorney Charles B. Whittlesey stated that the report was voluminous and more time was required. Judge Kellogg has also approved the application authorizing the receiver to pay the interest due on the bonds of the Groton & Stonington Street Railway, as it was represented to the court that paying the interest would prevent default and perhaps permit the receiver to dispose of the road to better advantage.

Receivers for Rock Island Southern Company.—Federal Judge Martin J. Wade of the Southern District of Iowa has appointed C. N. Abbott, vice-president of the Central Trust Company, Chicago, and C. H. Bacon, vice-president, in charge of operation of the Chicago, Rock Island & Pacific Railway Company, as receivers for the Rock Island Southern Railway Company. Judge Fitzhenry of the Federal Court at Peoria has concurred in the action of Judge Wade. The Mississippi Valley Railway & Power Company, controlled by Walsh Brothers, owns more than one-half of the outstanding bonds of the Rock Island Southern. Under government control steam trains were substituted for electric cars.

Last Traces of Municipal Railway Removed.—The last traces are being removed of the Yazoo (Miss.) Municipal Railway, which suspended operation in November, 1918. The Meridian (Miss.) *Dispatch* of March 18 under a date line from Yazoo City said: "The last remnant of the Yazoo City street car line has been disposed of, the Goldstein Hide & Fur Company having sold the old cars and trailers to Helena, Ark., to be rebuilt and used. The doing away with the line is a source of regret to many, and even though the railway did not make expenses the other utilities were making money and it all belonged to the city and the loss was nothing short of taking money from one pocket and putting it in the other."

An Offering That Is Different.—The Carolina Beach Railway, Wilmington, N. C., is seeking to finance itself through the sale of securities direct to the public. The company is offering $500,000 of 6 per cent ten-year gold coupon bonds "secured by a first mortgage on all the property owned by the Carolina Beach Railway." The company is described as building a railway from the city of Wilmington to Carolina Beach, which is located on the mainland and only 13 miles south of the city. No mention is made of the offering price, but "a bonus of 10 per cent of the common capital stock is offered to the purchaser of each $1,000 bond on the first $100,000 of these bonds sold." There is also a land exchange feature.

Will Sell Additional Stock.—Henry J. Davies, treasurer of the Cleveland (Ohio) Railway, has notified stockholders that it is now necessary to sell the remaining 10,000 shares of stock in the treasury in order to make needed improvements in the way of buildings, track and power equipment, as well as purchase land for its purposes. The requirements are that this stock must be sold at par or above, although it has been around 96½ and 97½ on the market for the past few days. Mr. Davies points out that the Cleveland and Lakewood franchises have been extended to May 1, 1944, and that an increase in the maximum permissible fare to 6 cents or nine tickets for 50 cents has been made. The quarterly dividend due on April 1 was based upon the new 7 per cent annual rate, granted by the Council some time ago, although an attempt is being made to have the ordinance increasing the rate from 6 to 7 per cent submitted to a referendum vote. Additional petitions for this referendum were certified to the City Council by City Clerk C. J. Benkoski on April 5. Councilman Henry C. Gahn, in charge of the fight for a referendum, will prepare a resolution for submitting the question to a vote and this will be acted upon at the next meeting of the Council.

Traffic and Transportation

Columbus Fares Advance

Go to Six Cents Under Provisions of Weinland Ordinance—Men Receive Pay Increase

A 6-cent cash fare with five tickets for 25 cents went into effect in Columbus, Ohio, on April 3. On that date the new franchise for the Columbus Railway, Power & Light Company, granting the company an increase in fare, became operative. The wages of the company's employees have been increased to a maximum of 50 cents an hour.

Under the terms of the franchise ordinance, which was passed by the City Council on Feb. 9, the 6-cent cash fare will continue for a six-year period. During the first two years tickets will be sold at the rate of five for 25 cents, and during the remaining four years at the rate of six for 25 cents. Free transfers and 10-cent owl car service are also provided. Children under six years of age will be carried free. Three cents is to be the rate for children between the ages of six and ten years.

$2,400,000 for Improvements

In return for the higher fare the company is required to spend $2,400,000 during the six-year period for extensions, street paving and repaving and the laying of new tracks. Expenditures are limited to $750,000 a year. The Council, when it deems necessary, can order the company to extend its lines in North High Street, West Mound Street and other thoroughfares, such extensions not to exceed five miles within the next six years. The company is not to be compelled to build more than two miles of new track in any one year.

A wage advance amounting to 5 cents an hour in the case of carmen and to 12 per cent in the case of shopmen has been awarded the employees of the company by the board of arbitration which has been considering their demands. The arbitration of future disputes between the company and the union is also provided for in the board's report. Platform men for the first three months will receive 45 cents an hour, for the next nine months 48 cents and thereafter 50 cents.

The new scale was effective April 1 and is retroactive to Jan. 1 and is to run until March 31, 1921. Extra platform men receive a minimum wage of $18 a week. Following is the wage scale of all other employees: Train dispatchers, $128 a month; pitmen, 50 cents an hour; track laborers, 40 cents; trackmen, 45 cents; curve cleaners, 40 cents; truckmen, 57 cents; helpers, 47 cents, and machinists, carpenters, blacksmiths, electricians and painters, 67 cents.

Enactment of the fare measure, known as the "Weinland bill," resulted from the need on the part of the company for an increase in revenue to meet these wage advances. The men struck last year, demanding a substantial raise in pay. S. D. Hutchins, of the Westinghouse Traction Brake Company, chairman of the board of arbitration, appeared before the City Council several months ago and asked that the company be permitted to raise its fare so that it would be in a position to meet the terms of the arbitrators' award.

Council's Aid Sought

Mr. Hutchins stated on that occasion that the arbitrators would withhold their award pending action by the city authorities on the question of granting the company financial relief. Presenting a statement of the company's financial condition, he declared that, unless a higher fare were allowed, the company could make no further increase in wages. The company subsequently presented a tentative draft of a bill providing for a 6-cent cash fare and in other respects similar to the ordinance later enacted by the Council.

Opponents of the fare increase made a concerted effort to defeat the Weinland measure through the medium of a referendum. Petitions to submit the question of allowing the higher fare to the voters at a referendum election were circulated. More than 16,000 names were signed to these petitions. However, the City Clerk rejected 8,783 signatures. The petitions therefore lacked 1,256 signatures of the 8,740 necessary to certification.

The fare increase will, it is estimated, give the company additional revenue of $1,100,000 a year.

Rhode Island Appeals Heard

The Rhode Island Supreme Court has taken under advisement the appeal of nine municipalities from orders of the State Public Utilities Commission authorizing the Rhode Island Company, Providence, to increase its fare. The fare increase that gave rise to the appeals went into effect May 5, 1918, when a central 5-cent fare and transfer zone of 2½ miles air line radius about the Providence traffic center and of 2 miles air line radius about the traffic centers of Pawtucket, Woonsocket and Riverpoint was established. On Sept. 23, 1919, by order of the commission a 6-cent fare was authorized in all zones and a 2-cent charge for transfers. At the hearing before the Supreme Court the towns contended that the commission exceeded its authority in permitting the company to raise its fare on these occasions.

Merchants Promise Aid

State Chamber of Commerce of Connecticut Recommends Legislative Relief Previously Refused

A special committee of the State Chamber of Commerce of Connecticut engaged on a study of electric railway conditions in that State has decided to recommend to the chamber that that organization ask the 1921 session of the Legislature to relieve the electric railways of all paving and bridge assessments, as well as taxes on gross income which are payable to the State.

The Connecticut Company, which is petitioning the Public Utilities Commission for the retention of a zone fare collection system, put into effect on Nov. 2 last, will be the greatest gainer if the proposed legislation should be adopted, as it operates over 90 per cent of the electric railway mileage in the State. The utilities commission is expected to make public its decision in the matter of the zone fare system within a few days.

The special committee of the chamber which conducted the investigation consists of Attorney Arthur M. Waitt, Sharon, chairman; J. B. Milliken, president of the Yale & Towne Mfg. Company, Stamford; Morgan B. Brainard, federal trustee of the Connecticut Company and vice-president of the Aetna Life Insurance Company; Robert W. Perkins, receiver of the Shore Line Electric Railway; George T. Kimball, secretary of the American Hardware Corporation, New Britain; Attorney Lucius J. Stevens, Clinton, and Ira M. Ornburn, secretary of the State Federation of Labor.

Details of Report Withheld

Roger W. Davis, Hartford, who attended the hearings on the zone fare system in behalf of the committee, has issued a report to the members, but details of this report are withheld pending the decision. The 1919 session of the Legislature was asked to pass legislation of the nature recommended by the committee of the Chamber of Commerce, but refused to do anything to help the overburdened companies. Since that time the companies have fallen into worse straits and it was in an effort to save the lines that the state chamber named the committee of inquiry.

In addition to the other assessments the Connecticut Company must pay, the city of Hartford levies upon it 2 per cent of the gross income on lines within the city.

Safety Suggestions Accepted

As a result of the safety work being conducted on the Chicago, North Shore & Milwaukee Railroad, Highwood, Ill., the employees have made 1,700 suggestions for improving safety conditions during the last three years. Of these 90 per cent have been accepted and put into force by the company with the result that the number of accidents has been materially reduced.

Zone System in Connecticut Modified

Commission Convinced System Is Correct in Principle—State Relief Suggested—Changes Effective May 9

The zone fare system of the Connecticut Company is sustained in the decision of the Public Utilities Commission made public April 9, but important modifications in the scheme will force the company to change over all its zone limits, issue commutation and school tickets and generally rearrange its accounting methods. The rates imposed by the commission will go into effect on May 9, but if "after a reasonable time" they are found to be unfair to company or public, the commission promises that it will reopen the case. The mileage system which the company placed in operation on Nov. 2, of last year, and which was attacked by representatives of nearly a score of towns, is declared a fair method of fare collection by the commission. The commuters of the town of Manchester, who had been arguing that a commutation rate of twenty years' standing should not have been shelved last November, won their point, the commission deciding that the daily riders in towns having a population of 25,000 or more shall have a lower rate.

Salient points in the decision are:

All zones throughout the company's lines are to be 1 mile in length, instead of present system, which makes initial zone in four largest cities of State 1½ miles, with second zone 1 mile. Smaller towns at present have 1.2 miles initial zone, 1 mile second zone. Country places at present have all zones 0.625 of a mile.

Cash fare is 6 cents for smallest two zones or any portion thereof, as at present, with 3 cents for each additional zone.

Zone ticket books containing fifty tickets sold for $1, with not less than three tickets to be collected for a ride in three zones or less and one ticket for each additional zone.

Monthly commutation tickets good for daily rides between traffic centers of cities and boroughs having a population of 25,000 or more and points five zones distant from the traffic center, the tickets to be at rate of 1.75 cents per zone.

School tickets to be at rate of 1 cent per zone, with initial charge of 3 cents for ride of three zones or less, with charge of 1 cent for each additional zone after the first three.

Present transfer system, which requires payment of 2 cents per zone if passenger has traveled more than two zones on first initial ride, is continued with modifications to meet the new system of fare collection.

The decision does not apply to the portion of the Shore Line Electric Railway, Norwich, recently acquired by the company.

Legislative Relief Recommended

The commission recommends that legislation be enacted to relieve the company of present street paving taxes, bridge building taxes and unfair jitney automobile competition.

The company officials had no comment to make on April 9 on the decision.

The hearing on the protests of the towns against the present system of fare collection started in December, and when final oral arguments were made on March 2 the commission told a representative of the ELECTRIC RAILWAY JOURNAL that the decision would be announced early in April. The commission is composed of Richard T. Higgins, Winsted, chairman; Charles C. Elwell, New Haven, and Joseph W. Alsop, Avon. The towns which appeared in opposition at the hearing were New Haven, Meriden, Bridgeport, Norwalk, Stamford, Milford, Hamden, New Britain, Orange, Newington, Berlin, Bloomfield, Plainville and Southington.

Portions of the commission's findings of especial interest follow:

It is a recognized fact, admitted by all the evidence in this case, that street railways supply a necessary public service not only for urban but for suburban and inter-urban transportation, and their suspension would be a public calamity. Some of the elements producing the precarious street railway conditions in this State are beyond the power of this commission to overcome, and can only be remedied by legislative enactment. Statutory burdens such as street paving, bridges, taxes and unfair automobile competition are among these elements. The labor competition of industrial enterprises which are unrestricted in the selling price of their commodities is an economic condition which the carriers themselves must work out.

Law of Diminishing Returns a Factor

The depreciated purchasing value of the dollar and the high and increasing cost of producing service are factors which should naturally be met by corresponding increases in rates, but there is a limit at which increased rates will produce increased revenue.

The duty of a utility company is not only the rendition of a public service, but the rendition of good and adequate service. This commission is fully aware of the fact that to render such service a company must have sufficient finances, sufficient gross revenue to pay all its operating expenses, fixed and overhead charges, set aside by a proper depreciation reserve, and pay a fair return on the investment. We feel that any order of the commission not based on this general policy would work not only an injustice to the company but to the public entitled to receive such service.

Street railway service is a direct benefit not only to its patrons, but to the communities, business industries, property owners in the localities served; and yet under present conditions all the expense of supplying such service, including statutory and collateral obligations, is borne by the car riders, they being the only source of revenue to the company.

The company, whose public duty is to carry passengers over and along the highway, is required to expend large sums of money for cleaning the snow and ice off the streets, for the construction of highway bridges and for paving and maintaining a large portion of the street area. No other individual or corporation using the highway is required to perform or directly pay for such work. The more of these expenses the company has to pay the greater will necessarily be the rates of fare for the car rider.

Pavement Costs a Serious Burden

The demand for improved and expensive pavement in our public highways and the very expensive care and maintenance of that pavement are due largely to automobiles, jitneys and trucks constantly using the highways, and in the case of the heavily loaded truck, using pavement destroying chains or other worse forms of non-skid devices.

The car rider is not only called upon to maintain the tracks and roadbeds of the particular company which affords him transportation, but is required to assist in maintaining a free roadbed and expensive type of pavement for the limousine, the numerous pleasure and touring cars, the constantly increasing number of heavy trucks and for the so-called public service automobiles or jitneys running in competition with his own company.

The person using the automobile in any and all of its various forms and types has the right-of-way provided, built and maintained by public taxation and by direct contribution of the street car rider.

A rate sufficiently high to meet all such expenses and afford a fair return on the value of the property or the actual investment therein, taking into consideration the nature of existing competition, would have a tendency to lessen street railway travel disastrously and destroy the usefulness of the carrier in supplying what should be a cheap, convenient and reliable form of transportation available to all the people.

It has for some time been a recognized fact in street railway operations that the old system of flat fares with its flagrant inequalities and numerous long haul rides at an absolute loss to the company must be abandoned if the company is to be self-supporting. It is unquestionably true that the long zone or flat rate system is popular and convenient and that it contributed materially in the building up of suburban sections and in relieving city congestion, but the inability of the company to continue such a system longer makes it imperative for the preservation of service to adopt a more business-like policy, unless aided by the State or municipalities served. Such aid cannot be forthcoming at the present time and it becomes necessary to adopt some other system or a radical modification of the system

It seems to the commission that the most equitable policy thus far suggested or adopted is the zone or distance tariff system, and accordingly the commission will retain the general basic principle of the zone or distance tariff system adopted by the company in the rates which it may prescribe hereunder. . . . .

Co-operation Essential

To make any rate or policy established by the commission satisfactory requires acquiescence and an honest endeavor on the part of the company and its employees to render good service, and a spirit of co-operation and good will on the part of the public. The enterprise and degree of service rendered by the respondent company during the past winter months, which were almost unprecedented in the severity of weather, affecting all kinds of transportation, were indeed commendable and we believe helped to awaken public sentiment to the necessity and importance of sustaining and preserving the street railway service. The commission being firmly convinced of the equity and fairness of the rates herein proposed and decreed under present conditions, earnestly requests the assistance and co-operation of the company and of the general public in making them a success or at least of giving them a fair trial. If at the end of a reasonable period of time it is demonstrated that the rates or system are unfair, either to the company or to the traveling public, this commission, upon proper presentation will unhesitatingly and without prejudice by the reason of anything herein stated or decreed, consider and revise such rate or system in accordance with facts then presented.

One-Man Car Order Rescinded

Unless the Wisconsin Railway Light & Power Company, La Crosse, Wis., is permitted to install one-man safety cars on its lines in that city it will be compelled to ask the Railroad Commission of Wisconsin for authority to increase fares, according to the company's answer to the protest of the city of La Crosse against use of one-man cars.

The state body recently granted the company permission to install eight one-man cars—a permission that was later rescinded when the protests of La Crosse citizens began pouring in to the commission in Madison.

The company sets forth in its answer that it is at present operating without a reasonable return on its investment despite the fact that a 6-cent fare is being charged.

The company planned to purchase eight new cars at once and convert the present rolling stock from two-men to one-man type.

The Railroad Commission will shortly hold a public hearing on the matter in La Crosse.

Transportation News Notes

Wants 10 Cents in Portland.—Ten-cent cash fares are asked in a petition filed by the Cumberland County Power & Light Company, Portland, Me., with the State Public Utilities Commission. The company proposes to increase the ticket rate from 7 cents to 8 cents. The cash fare is now 9 cents.

To Probe Phoenix Service.—A committee representing the City Commission and local business interests has been appointed by Mayor Corpstein of Phoenix, Ariz., to make a thorough study of the condition of the Phoenix Railway. The request for an investigation of the company's service took the form of a petition signed by a large number of citizens.

More Cars Asked for St. Louis.—Hearings were begun on March 30 before Special Master Lamm on the application of Rolla Wells, receiver for the United Railways, St. Louis, Mo., to spend $2,000,000 for the purchase of 160 additional cars, $917,380 for track reconstruction within the city and $140,200 for track reconstruction on the St. Charles line in St. Louis County. The company proposes to rebuild about 31 miles of city line.

May Raise Cincinnati Fare.—It is reported that the platform employees of the Cincinnati (Ohio) Traction Company will ask for an increase in wages from a maximum of 50 cents an hour to a maximum of 75 cents an hour, when their contract is readjusted on July 1. If this increase should be granted, it is believed that the rate of fare will have to be increased ½ cent to cover it. The rate is now 7 cents, with universal transfers.

Seven Cents Asked in Austin.—The Austin (Tex.) Street Railway has filed a petition with the Austin City Council asking authority to increase its fare from 5 cents to 7 cents for adults and from 2½ cents to 3½ cents for children. The Chamber of Commerce after an investigation of the earnings and operating expenses of the company has recommended that the increase be granted for a period of five years. The City Attorney has been instructed to draft an ordinance giving the company the requested increase.

Traffic Survey at Springfield.—The City Council of Springfield, Mass., has voted $3,000 for a survey of traffic conditions in that city. Peter Witt, Cleveland traffic expert, has agreed to conduct the investigation on condition that he will have the co-operation of the Springfield Street Railway. Assurances have been given that such co-operation will be forthcoming and that any reasonable suggestions for speeding up service will be carried out.

Deprecates City's Attitude.—The attitude of the city of Pittsburgh, Pa., toward the decision of the Public Service Commission of Pennsylvania, in regard to the valuation of the Pittsburgh Railways property, recently announced in these columns, was deprecated by A. W. Thompson, president of the Philadelphia Company, the holding concern of the traction company, speaking at the weekly dinner of the Current Topics Club in the Knights of Columbus Clubhouse on April 5. Mr. Thompson charged that a lack of interest on the part of the public was responsible for the failure of the public utilities companies to give proper service.

Commission Ouster Bill Fails.—A bill which, had it been enacted, would have automatically removed the members of the New Jersey Board of Public Utility Commissioners from office was defeated on April 5 in the State Assembly. The bill proposed to take from Governor Edwards the power to appoint a new board. Under the bill as originally drafted the members of the proposed new commission would have been elected by the Legislature in joint session, but when the measure was placed on third reading it was amended to provide for their appointment by the Chief Justice of the Supreme Court.

Wants Buses in Dallas.—Would-be jitney operators of Dallas, Tex., have appealed to the State Court of Civil Appeals in an effort to obtain a franchise to operate a bus route in competition with the lines of the Dallas Railway. Petition for a franchise from the city was presented to the City Commission by Currie McCutcheon and Marion S. Church. This was denied by the City Commission. Mandamus was then sought in the District Court to compel the city authorities to submit the proposed franchise to a referendum vote. The District Court declined to issue the order prayed for. Notice of appeal has been given from the ruling of the District Court and the question will soon come up for hearing before the Court of Civil Appeals.

Would Lower Worcester Fare.—A 5-cent initial fare with a 3-cent charge for a transfer would solve the difficulties of the Worcester (Mass.) Consolidated Street Railway, in the opinion of Mayor Peter F. Sullivan of Worcester. Mayor Sullivan has addressed an open letter to Clark V. Wood, president of the company, urging the adoption of the "five-and-three" plan. The Mayor contends that this plan would best serve the company's interest and at the same time would benefit the people of Worcester. Under the fare system now in effect the city is divided into two zones with a 7-cent fare in each and with no transfer privilege. If the "five-and-three" plan failed to supply adequate revenue, the Mayor states that he would advocate a 6-cent fare with a 4-cent transfer charge. Under the zone plan the fare in each zone was originally 5 cents. It was then raised to 6 cents and subsequently to 7 cents.

Will Reroute Los Angeles Lines.—Sweeping plans for the rerouting of its lines have been announced by the Los Angeles (Cal.) Railway. The rerouting program was worked out by the company at the suggestion of the State Railroad Commission, and will be put into effect about May 1. The commission recommended the adoption of drastic measures for the relief of congestion in the city's business district. The City Council has already passed a "no-parking" ordinance, as previously announced in the ELECTRIC RAILWAY JOURNAL, which becomes effective on April 10. Under the terms of the ordinance the parking of vehicles within the congested area is barred between the hours of 11 a. m. and 6.15 p. m. As a result of the rerouting of car lines and the enforcement of the anti-parking rules, the company hopes to decrease the present car headway by 50 per cent.

Favors Zones for Hudson Tubes.—The Interstate Commerce Commission has suspended a tariff filed with it by the Hudson & Manhattan Railroad, New York, N. Y., under which the company proposed to charge a straight 8-cent fare. In a letter to Oren Root, president of the road, the commission stated in effect that it would grant an increase on a zone system rather than the straight 8-cent fare requested by the company. It was indicated by the commission that the company was entitled to a 6-cent fare from Hoboken and Jersey City to the Hudson Terminal and a 10-cent fare from the Jersey terminals to uptown New York. The letter gave permission to file tariffs on these increases and intimated that the increases would be allowed. The company asked for a straight 8-cent fare, which would have given it an increase of $3,213,117, or 4.7 per cent, while the proposal of the commission would increase the revenues by $2,344,012, or 4.32 per cent on its allocated debt of $70,263,300. The company will file the new rate.

Acute Car Shortage in Dallas.—The Dallas (Tex.) Railway is losing $400 a day because of shortage of cars to handle passengers, according to Richard Meriwether, vice-president and general manager. This estimate is based on the number of persons passed up by the cars of the company during the morning and evening rush hours because of the lack of cars to haul them. During the rush period in the morning an average of 19,640 persons are carried every day. Of this number, approximately 13,960 are seated. The others are forced to stand. During the rush period in the evenings an average of 21,665 are carried daily, of which number 14,233 are seated. An average of 36.2 per cent of the passengers hauled stand up in the evenings and 32.2 per cent of those hauled stand up in the mornings. Investigation discloses that fully one-half of those persons passed up by the cars during the rush hours either walk to work or seek some other conveyance.

Personal Mention

Mr. McClure at New Post

Made Vice-President in Charge of Operation of Ohio Electric Railway

J. Harvey McClure, general manager of the Citizens' Traction Company, Oil City, Pa., has been selected by Day & Zimmerman, utility managers, to operate the Ohio Electric Railway, Springfield, Ohio, of which they have taken charge. Mr. McClure has been given the title of vice-president of the Ohio Electric in charge of operation. He has already taken up his new duties, making his headquarters at Lima, Ohio.

Mr. McClure's new position, by enlarging the scope of his duties and responsibilities, will give him further opportunity to demonstrate his methods, which have met with marked success in Oil City for several years. As manager of the Oil City properties of Day & Zimmerman he has not only proved his ability to operate the lines in his care in an efficient and economical manner, but has made for himself a name for fairness and square dealing among the people of Oil City and Franklin.

His new duties will call for exercise of these qualities on a much larger scale. The Ohio Electric Railway operates 530 miles of city and interurban line in both Ohio and Indiana. The road connects Toledo, Lima, Defiance, Springfield, Dayton, Union City, Columbus and Zanesville, in Ohio, and Fort Wayne and Richmond in Indiana. The road was placed under the direction of Day & Zimmerman on April 1.

Mr. McClure has been connected with the Citizens' Traction Company since 1913. At that time he had already been in the service of Day & Zimmerman for several years. In 1914 he was made general superintendent of the Oil City and Franklin lines, and was subsequently advanced to general manager. He has also served as general manager of the Citizens' Light Company and the Monarh Park Hotel Company. In 1918 he was appointed vice-president in charge of operation of the Youngstown & Suburban Railway, Youngstown, Ohio. Since receiving his appointment with the Ohio Electric Railway he has resigned from these companies.

Co-operation and harmony have characterized Mr. McClure's tenure of office at Oil City. Upon assuming his duties there he adopted a policy of candidness and fairness toward the public as well as toward the company's employees. Constantly adhering to this policy, he set out to build up the property. Under his direction numerous improvements and extensions have been made. The results of his methods are seen in the fact that, although the company has increased its fare twice, first to 6 cents and more recently to 7 cents, the rate advances have not evoked a public protest.

New Seattle Manager

David W. Henderson, Superintendent of Transportation, Placed in Charge of Municipal Railway

David W. Henderson, superintendent of transportation of the Seattle (Wash.) Municipal Street Railway, has taken up the duties of general superintendent of the system. Mr. Henderson, who assumed the direction of the municipal lines following the resignation of Thomas F. Murphine, has been permanently appointed to the position of general superintendent by Mayor Hugh M. Caldwell.



D. W. HENDERSON

In his new capacity Mr. Henderson will have charge of the entire municipal railway system, comprising 235 miles of track. He does not, however, succeed Mr. Murphine as director of public utilities and thus has no control over the other utilities of the city. Mayor Caldwell, who during the mayoralty campaign attacked the methods of the municipal departments, has since his election divorced the railway from the public utilities department. E. D. O'Brien has been placed in charge of the latter.

Mr. Henderson has been connected with the Seattle traction system, at first under private and later under public ownership, for the past eighteen years. At the time of the purchase by the city of the Seattle lines of the Puget Sound Traction, Light & Power Company a year ago, he was superintendent of transportation. He entered the employ of the company in 1902 as a motorman. In 1907 he was advanced to the position of inspector and in 1911 he was promoted to assistant superintendent of transportation, serving under Guy A. Richardson, then superintendent of transportation. In May, 1912, Mr. Henderson was advanced to division superintendent. In November of the same year, he was appointed to the position of superintendent of transportation. He retained this position until April, 1919, when the lines were transferred to the city of Seattle.

Mr. Henderson was born in Dumferline, Scotland, on Feb. 24, 1873. His parents came to the United States in 1881, settling in Randolphe, Wis. He received his early education in Randolphe, completing a teacher's course at Valparaiso, Ind. For the next eight years he taught school in Wisconsin, after which he went to Seattle and entered the employ of the Puget Sound Traction, Light & Power Company.

Merritt Strahan has assumed the duties of division superintendent of the Union Traction Company of Indiana, Anderson, Ind., with headquarters at Indianapolis. Mr. Strahan has been connected with the company since 1910.

William H. Tobin has been appointed chief inspector of the Berkshire Street Railway, Pittsfield, Mass., to succeed Thomas E. MacDonald, resigned. Mr. Tobin has been in the company's employ for the past twenty years. Prior to his new appointment he served as an inspector.

Harry H. Adams, superintendent of shops and equipment of the Chicago (Ill.) Surface Lines, has been given the same title under the new organization plans of President Henry A. Blair, but he will report to the general manager instead of to the chief engineer as heretofore.

George W. Wells, who has been director of exhibits for the American Electric Railway Association, has joined the staff of the International Exposition of Industries, Grand Central Palace, New York City. He will have charge of the electrical division of the mechanical department.

F. J. Tew, who for the past seven years has been master mechanic of the Manila Electric Railroad & Light Corporation, Manila, P. I., is about to return to the United States. Mr. Tew expects to arrive in San Francisco during the present month. He has not yet made definite plans for the future.

John D. Wells, former director of publicity for the International Railway, Buffalo, N. Y., and former president of the American Press Humorists' Association, has become associated with William A. Morgan, financier, as advertising counselor. Mr. Wells was at one time managing editor of the Buffalo *Evening News*.

Henry M. Brooks, who has for a number of years been connected with the Insull interests, most recently as manager of the bond and stock department of the Middle West Utilities Company, Chicago, Ill., has resigned to go with W. G. Souders & Company, an investment house, and will be located in its New York office.

Changes in Chicago Elevated Organization

Changes in the organization of the Chicago Elevated Railways were announced by President Britton L. Budd on March 30, as follows:

Bernard J. Fallon, engineer maintenance of way, was appointed assistant general manager.

Edward J. Blair, organization engineer, was appointed assistant to the president.

H. A. Johnson, superintendent of shops and equipment, was appointed organization engineer, having the duties of analyzing all operating methods, costs, etc., preparing statistical information and from time to time making recommendations as to improved or more efficient methods, practices or processes in all departments. He will report to the general manager.

R. N. Wade, track engineer, was appointed engineer maintenance of way and structure.

Adolph H. Daus, assistant to the superintendent of shops and equipment, was appointed superintendent of shops and equipment.

E. C. Davis, general manager of the Burlington County Transit Company, Hainesport, N. J., has resigned.

Thomas E. MacDonald, chief inspector of the Berkshire Street Railway, Pittsfield, Mass., has resigned.

Frederick Isaacson, superintendent of transportation of the Ottumwa Railway & Light Company, Ottumwa, Iowa, has resigned.

L. E. Hollar, superintendent of transportation of the Chicago, South Bend & Northern Indiana Railway, South Bend, Ind., has resigned.

C. U. Peeling has resigned as general manager of the Cornwall Street Railway, Light & Power Company, Cornwall, Ont.

G. C. Miller, manager of the light and power departments of the Aurora, Elgin & Chicago Railroad, Elgin, Ill., has resigned to engage in the electrical merchandising business in Kokomo, Ind.

W. L. MacFarlane has been appointed general manager of the Cornwall Street Railway, Light & Power Company, Cornwall, Ont., succeeding C. U. Peeling, resigned.

Richard Kelly, general passenger agent of the Pacific Electric Railway, Los Angeles, Cal., has been made general passenger agent of the Southern Pacific Railroad, reporting to Vice-President Paul Shoup.

Elvin L. Hoffler has been appointed an assistant superintendent of the Wilkesbarre (Pa.) Railway. Mr. Hoffler has been employed as a bookkeeper in the auditing department of the company for the past fourteen years.

W. W. Waterson, superintendent of transportation of the Chicago, Ottawa & Peoria Railway, Ottawa, Ill., has succeeded L. E. Hollar as superintendent of transportation of the Chicago, South Bend & Northern Indiana Railway, South Bend, Ind. Mr. Waterson joined the Illinois Traction System in 1904 as a trainman. Shortly thereafter he was promoted to train dispatcher. In 1912 he was appointed superintendent of the Peoria division of the St. Louis, Springfield & Peoria Railroad and five years later he was made superintendent of transportation of the Chicago, Ottawa & Peoria Railway.

F. E. Smith, Comptroller

Former Auditor of Chicago Union Traction Company Joins McGraw-Hill Staff

F. E. Smith, for fifteen years auditor of the Chicago Union Traction Company and of its successor, the Chicago Railways, has joined the McGraw-Hill organization with the title of comptroller. He entered actively upon his duties on April 1, 1920. Since May, 1918, and up to within the last month



F. E. SMITH

or two, Mr. Smith has been connected with the United States Shipping Board, Emergency Fleet Corporation, first as local auditor at Hog Island, where he built up a large auditing staff, and later at the headquarters in Philadelphia in the comptroller's office and in the department of cancellation, claims and contracts, which dealt with the claims arising from cancellations.

Mr. Smith's professional career has been largely with railroads, particularly electric railways. A native of Connecticut, his first railway experience was gained with the Hartford, Providence & Fishkill Railroad, now a part of the New Haven system. Two years later, or in 1884, he moved to Akron to join the accounting force of the Cleveland, Akron & Columbus Railroad, leaving that company in 1889 to become auditor for the receiver of the Zanesville & Ohio Railroad. During the five-year period in which he was connected with this company, he made numerous investigations of the financial condition of the properties of the Hollins-Clark Syndicate, the representatives of the bondholders of the Zanesville property.

In April, 1894, he was transferred to the position of auditor of the Lynn & Boston Railroad, which had passed into the control of this syndicate, and in 1899, when this property became a part of the Massachusetts Electric Companies, he was appointed by the new interests general auditor of the consolidated lines. In July of the same year, when the Hollins interests assumed control of the North and West Chicago Street Railways and organized the Chicago Union Traction Company, Mr. Smith was appointed its auditor, a position which he retained, as mentioned, until 1914, when the Chicago Surface Lines took over the operation of the surface lines in Chicago. He then moved to Florida and engaged in raising grape-fruit until his return north in 1918 to join the Emergency Fleet Corporation.

While connected with electric railway companies, Mr. Smith took an active part in association work. For two years he served on the executive committee and for six years on the committee on the standard classification of accounts of the Street Railway Accountants' Association of America, and in 1903-1904 was president of that organization.

W. S. Anderson has been appointed assistant to H. L. Mitchell, vice-president of the West Penn Railways, Pittsburgh, Pa. Mr. Anderson was formerly chief clerk in the company's Connellsville (Pa.) office. At the time of his promotion to his new position his fellow employees presented him with a gold watch as a token of remembrance.

Horace E. Miller, who was recently appointed chief dispatcher of the Pacific Electric Railway, Los Angeles, Cal., joined the company as a towerman in 1908. In 1910 Mr. Miller was promoted to dispatcher on the south division. He became assistant trainmaster in January, 1919, continuing in that capacity until his advancement to chief dispatcher.

W. H. Evans, assistant to the claim adjuster of the Wilkesbarre (Pa.) Railway, has been promoted to the newly created position of assistant superintendent. Mr. Evans entered the employ of the company nineteen years ago as a trainman. He served both as a conductor and a motorman, and was later advanced to inspector. He became assistant to the claim adjuster three years ago.

F. S. Welty, purchasing agent of the Omaha & Council Bluffs Street Railway, Omaha, Neb., has been promoted to assistant general manager of the company. In his new capacity Mr. Welty retains supervisory authority over the purchasing department, of which he has been in charge for the past thirteen years. He joined the company twenty-two years ago. For eight years he was connected with the transportation department. He was then transferred to the claim department, where he served for one year, at the end of which he was made purchasing agent.

A. B. Cronk has succeeded O. B. Gothlin as chief of the tariff bureau of the Indiana Public Service Commission. Mr. Cronk has for some time been serving as a deputy in the office of the Attorney General of Indiana.

William P. Burr, corporation counsel of New York City, has been appointed a Justice of the State Supreme Court. Mr. Burr has taken a prominent part in the New York City Board of Estimate's traction inquiry, conducting the case for the city.

O. E. Sterner has been appointed superintendent of transportation of the Ottumwa Railway & Light Company, Ottumwa, Iowa, to succeed Frederick Isaacson, resigned. Mr. Sterner has been connected with the company for the past twelve years.

A. M. Evans, assistant to the chief engineer of the Chicago (Ill.) Surface Lines, has resigned to accept a position in the organization of the Geyser Electric Company, Chicago, manufacturers of washing machines. Mr. Evans has been with the Chicago City Railway and the Chicago Surface Lines since 1906. During the war he served under Colonel Peter Junkersfeld as an officer in the construction division of the Quartermaster's Corps.

O. P. Gothlin, chief of the tariff bureau of the Indiana Public Service Commission, resigned on April 1. Mr. Gothlin will resume the practice of law. He will specialize in transportation matters, handling only cases relating to railroad rates and service. Mr. Gothlin was formerly chairman of the Ohio Public Service Commission. He has been with the Indiana commission since June, 1917, as chief of the tariff bureau, in which capacity he reorganized the tariff department.

C. H. Crooks, whose election as president of the Fort Dodge, Des Moines & Southern Railroad, Boone, Iowa, was noted in the ELECTRIC RAILWAY JOURNAL for April 3, was born in Iowa in 1874. Mr. Crooks entered the traction business in 1893 as a ticket agent with the Des Moines Union Railway. Two years later he was made agent of the Des Moines, Northern & Western Railway at Fonda, Iowa, leaving that position in 1898 to become agent of the Chicago, Milwaukee & St. Paul Railway at Boone. Shortly thereafter he was appointed chief clerk to the division freight agent of the latter road at Des Moines, serving in this capacity until 1904. In that year he resigned to become chief clerk to the division freight agent of the Chicago, Rock Island & Pacific Railway at Des Moines. He was subsequently advanced to the position of commercial agent of the road at Des Moines, but resigned after a short term of service to join the Fort Dodge, Des Moines & Southern Railroad as general freight and passenger agent at Boone. In March, 1911, he was promoted to traffic manager. In October of the same year he was made general manager of the company.

Wisconsin Association Elects Mr. Lounsbury

William C. Lounsbury, general manager of the Superior Water, Light & Power Company, Superior, Wis., was elected president of the Wisconsin Electrical Association at its meeting at Milwaukee on March 25. Mr. Lounsbury had served as the association's president during the greater part of last year. When Raymond C. Smith, who was chosen president a year ago, resigned last June on removing from the State, Mr. Lounsbury, as first-president, was advanced to fill the vacancy.

Mr. Lounsbury's fine sense of humor was well demonstrated by the able and pleasing manner in which he presided over the meeting of the association recently. This sense of humor may also be seen in what follows, which is the result of a request made upon him for the details of his training and experience. He is quoted verbatim, for a man's autobiography is not often so readable as his. This is what Mr. Lounsbury has to say about himself:



W. C. LOUNSBURY

I was born, through no fault of my own, on Friday the thirteenth day of February, 1880. After a few years, most of which I presume were spent in making as much noise as possible, I was taken under protest to Boston at the age of five and subsequently lived there long enough to receive as much public school education as is ordinarily given. After some strenuous effort I was graduated from the Massachusetts Institute of Technology in 1904. The subsequent few years were spent in Worcester, Washington and New York, doing what I then thought was extremely valuable work for my employers. This I have since found to be quite contrary to facts, but there is no doubt it was profitable to myself.

Coming to my present company some thirteen years ago, I made a very creditable record in lessening costs in the water department and in connection with the construction work, over which I had general charge. In 1912 I was made general superintendent, with supervision over the operation of our water, gas and electric departments. Since 1918 I have been general manager.

I have the honor of paying dues to the National Electric Light Association, American Water Works Association, New England Water Works Association, American Public Health Association, and for some reason still a mystery to me I was elected a fellow in the American Association for the Advancement of Science. I have been more or less active in several Wisconsin State associations, including the Wisconsin Society of Engineers and the Gas & Electric Association. I am a member of the local Rotary Club and for several years have been a member of the Superior Park Commission, serving as its president in 1917 and again this year.

Obituary

Francis S. Williams, for a number of years connected with the legal department of the Interborough Rapid Transit Company, New York, N. Y., died on April 1.

A. N. Hargrove, formerly foreign sales manager of the J. G. Brill Company, died suddenly on March 27, in Philadelphia. Mr. Hargrove joined the Brill staff in 1905 and was widely known in the export trade. He was forty-one years of age.

Richard D. Simms, treasurer of the Capital Traction Company, Washington, D. C., died suddenly on March 31, at Asheville, N. C. Mr. Simms was commander of the District of Columbia National Guard, with the rank of brigadier-general. He was born in Washington fifty-one years ago. For twenty years he was employed by the District of Columbia. In 1905 he resigned his position as purchasing agent of the district to become treasurer of the Capital Traction Company. He was active in the affairs of the National Guard for many years. Joining that organization twenty-three years ago, he was made a major in 1899 and in 1909 was promoted to colonel. He retired in 1911.

G. A. Humphrey, superintendent of shops of the Sacramento Northern Railroad, Sacramento, Cal., died on Feb. 26. Mr. Humphrey was born in England in 1851. Coming to the United States at the age of sixteen years, he went to work for the Missouri Pacific Railroad as an apprentice in the mechanical department. He remained in the employ of the Missouri Pacific for more than thirty years, serving successively as mechanic, car builder and master mechanic. He later worked for the Père Marquette System as master car builder. He joined the Sacramento Northern Railroad as superintendent of shops in 1907.

Thomas J. Nicholl, who for many years was vice-president and general manager of the old Rochester (N. Y.) Railway is dead. Mr. Nicholl had made his home in Rochester for several years before his death. He was seventy-four years old. Mr. Nicholl was born in England, the son of Thomas E. Nicholl, who was associated with Sir I. K. Brunnel in the construction of the Great Western Railway of England and later assistant engineer in the construction of the Grand Trunk lines in Canada. Mr. Nicholl was the first member of the first Street Railway Young Men's Christian Association. He was associated with many of the big steam railways before taking charge of the Rochester traction lines and the Rochester & Sodus Bay Railway. He was a brother of H. A. Nicholl of Anderson, Ind.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Insulation Material Prices Higher

Cotton and Silk Goods and Varnishes Higher by from 5 to 20 Per Cent—Shipments Long

Insulating materials are characterized by longer shipments and higher prices. Spot cotton in New York is quoted at 42.50 cents. Prices on cotton webbing, tape, tubing, varnished cambric and friction tapes advanced the last week in March about 5 per cent. The demand for cotton insulations is heavy and shipments from the factory are about three months. Finishing mills are hard put to it to get yarns for electrical uses because of the heavy demands on this material from other sources.

The auomobile industry is using greater and greater amounts of long staple cotton in the manufacture of cord tires and in the upholstering and in tops. Consequently the electrical trade feels the reaction in higher prices and longer deliveries. At the same time labor turnover in the mills is rather too rapid for economical operation.

Varnished silk cloth and tape is reported 20 per cent higher than two weeks ago. Shipments are in general longer than for cotton goods because of a greater shortage of the semi-finished product. One producer of silk insulation is still shipping on orders of last June.

Within the last ten days insulating varnishes have advanced about 5 per cent.

Railways Face Long Deliveries on Insulators

Increased Export Demand and Malleable Shortage Responsible for Present Conditions

As the result of heavy ordering of high tension insulators by foreign interests and unimproved factory conditions in the malleable industry, railways now entering the market are being quoted from four to seven months on large orders of high tension insulators.

Large orders are coming from outside the country and payments are being made on the basis of cash on bill of lading, although some European countries are seeking longer terms. Italy and France are active in this field. The high cost of fuel in these countries is undoubtedly a great factor in the expansion of high-tension lines at this time. An order of 70,000 suspension units is being filled for shipment to Japan, for operation on 154,000 volts. It may be interesting to note here that an order for 10,000 units for this development has been placed in Japan. Among the orders for South America is one for 30,000 units of the 70,000-volt suspension type, destined for the Andes. Inquiries, too, for export trade are received in good volume.

Railways and power companies are ordering for maintenance purposes except in a few instances where extensions are being made.

These orders, however, are running into good volume as is witnessed by the long shipping dates quoted. These orders are increasing in volume and number and from the inquiries coming in give evidence of much work under contemplation.

Manufacturers of high-tension insulators have their hands full taking care of orders for shipment during the next six months. In general quotations are being made on a basis of shipment in four to six months, but there is still a certain amount of capacity, small, it is true, which can be turned over to care for special rush orders by moving ahead short time orders on which a slightly longer shipping date would make no difference to the buyer.

Factory production is reported at a little higher rate than earlier in the year. Labor is still regarded as the controlling factor in production, and its turnover is still rather high. Malleable shortage is giving considerable trouble in some plants, although at least one manufacturer reports a good supply coming from the foundry which has been his source for a good many years.

Prices on high-tension insulators were advanced from 10 to 20 per cent by at least one manufacturer, while others have reported no advance since early in the year.

1,376 Safety Car Equipments Ordered During First Quarter

Number of Equipments for First Three Months of 1920 Practically Equivalent to Number of Safety Cars for All of 1919 — 25 Per Cent of Railways Have Purchased Safety Cars

Safety car sales continue with a rush. Insistent increased demand from all sections of the country has resulted in the placing of 1,376 sets of safety car equipment during the months of January, February and March, 1920. This is one-half of one per cent less than the total number of safety cars ordered during the entire year, 1919.

Recent estimates made by electrical manufacturers, carbuilders and others place the number of safety cars to be built during the year at from 3,000 to 4,000 and the above total for the first quarter is conclusive evidence that these figures are conservative.

According to reports received from three of the four carbuilders who are manufacturing safety cars, production schedules are being increased and standard cars are being turned out as fast as they can be built regardless of the number on order. Lack of certain much-needed material, including sheet steel and equipment such as motors, control and airbrakes, is the only drawback which might seriously curtail production.

The purchasing power of the railways is another important factor which will directly affect production this year. At present, however, under the car trust certificate plan, purchases of safety cars are more easily arranged than for any other type. This is partly due to the marked economies that have been shown in the operation of safeties.

Rapid Increase in Sales

Production of safety car equipments was commenced during 1916 and in that year forty-nine sets of equipment were ordered. This must not be confused with apparatus used on many so called one-man cars which were not safety cars. Only those cars are included which were equipped by the Safety Car Devices Company. In 1917, 520 sets of equipment were ordered and 518 during 1918. Of course, both of these were war years and the railways bought fewer equipments than during a normal period. Last year, 1919, showed an increase in sales of equipments of about 240 per cent over 1918, a total of 1,791 sets of equipment having been ordered during the

SAFETY DEVICES ORDERED SINCE 1915

	1916	1917	1918	1919	First Quarter 1920
Equipments	49	520	518	1791	1376
Safety Cars	187	280	644	1383	*345
Number of Railways	41	44	52	100	70

*Safety cars ordered during January and February, 1920.

year. The difference between this number and the total number of safeties for 1919 represents the equipments ordered by manufacturers for future delivery and also those equipments which have been placed on old cars, reconstructed in the railways' shops.

No estimate has been made for the number of sets of equipment for the entire year 1920, but if the pace which has been set so far continues throughout the year, more than 5500 sets will have been ordered by Jan. 1, 1921. Up to the present time more than 200 different railways in the United States, Canada and Cuba have placed orders for safeties, showing the duplication of railways ordering this type of car to be about 33⅓ per cent. According to the latest McGraw Electric Railway Directory, dated February, 1920, there are now in operation 798 trolley and third rail properties in addition to the cable, storage battery, gas-electric and electrified steam lines. Hence, at this time more than 25 per cent of the railways on which it is possible to operate safety cars already have in operation or have purchased this type of equipment.

Rolling Stock

Chautauqua Traction Co., Jamestown, N. Y., recently lost a snow-plow and a freight car in a fire at Stow, N. Y.

Beloit Traction Company, Beloit, Wis., according to reports has placed an order for two safety cars.

Pennsylvania & Ohio Railway, Ashtabula, Ohio, is reported in the market for ten city cars.

Sunbury & Susquehanna Railway, Sunbury, Pa., is reported to have purchased several cars.

United Railways, St. Louis, Mo., through its receiver, Rolla Wells, has asked permission to spend $2,000,000 for the purchase of 160 new cars.

Iowa Railway & Light Company, Cedar Rapids, Iowa, is reported to have placed an order for six safety cars.

Franchises

Knoxville Railway & Light Company, Knoxville, Tenn. — The Knoxville City Commission has granted the Knoxville Railway & Light Company a franchise for a line in Jessamine Street and Pratt Avenue.

Track and Roadway

Edmonton (Alta.) Municipal Street Railway. — This company will install 7,000 No. 2 ties.

British Columbia Electric Railway, Vancouver, B. C.—The British Columbia Electric Railway plans to construct a new line at a cost of $25,000.

Sacramento Northern Railroad, Sacramento, Cal.—The Sacramento Northern Railroad is building a siding ½ mile in length in West Sacramento.

Sacramento Northern Railroad, Sacramento, Cal. —The Sacramento Northern Railroad will build a standard gage single-track line with overhead trolley system from its branch track in Yolo County, Cal., to serve the mills and warehouses along the Sacramento River.

Illinois Traction System, Peoria, Ill. —The Illinois Traction System is contemplating the installation of 20 miles of additional track circuit signal.

Dauphin, Man. — The municipality of Dauphin plans to build a railway line.

Eastern Massachusetts Street Railway, Boston, Mass.—The Eastern Massachusetts Street Railway plans to extend its line in Water Street, Lawrence, Mass.

Eastern Massachusetts Street Railway, Boston, Mass.—The Eastern Massachusetts Street Railway will repair the tracks of its Quincy division at a cost of $130,000.

Eastern Massachusetts Street Railway, Boston, Mass.—The Eastern Massachusetts Street Railway will rebuild 25,000 ft. of track in Fall River, Mass. It is planned to expend approximately $140,000 on the work.

Columbus Railway, Power & Light Company, Columbus, Ohio.—Under the terms of an ordinance which became effective on April 3, the Columbus Railway, Power & Light Company must spend $2,400,000 on track extensions and other improvements within the next six years.

Philadelphia (Pa.) Rapid Transit Company. — The Philadelphia Rapid Transit Company proposes to build a line through Adams Street, the Boulevard, Courtland Street, Windrim Avenue, Twentieth Street and Wingohocking Street, Philadelphia.

Steubenville & Wheeling Traction Company, Wheeling, W. Va.—The City Council of Steubenville, Ohio, has passed an ordinance under which the Steubenville & Wheeling Traction Company will be required to relay its tracks on Third Street, Steubenville.

Power Houses, Shops and Buildings

Los Angeles (Cal.) Railway — The Los Angeles Railway has begun work on a ten-story office building at the corner of Broadway and Eleventh St.

International Railway, Buffalo, N. Y. —A carhouse, eight passenger cars, three snow-plows and a sweeper belonging to the International Railway were destroyed by fire on March 21. The loss is placed at $60,000.

Toledo Railways & Light Company, Toledo, Ohio.—A substation belonging to the Toledo Railways & Light Company was destroyed recently, the loss amounting to $50,000.

Niagara, St. Catharines & Toronto Railway, St. Catharines, Ont.—The Niagara, St. Catharines & Toronto Railway plans to make extensive improvements in the St. Catharines district during 1920. The construction program calls for a total expenditure of $500,000. The plans include the erection of a new car shop at St. Catharines, to cost $50,000.

Trade Notes

Southwestern Engineering Company, Hutchinson, Kan., has opened a branch office at Fort Worth, Tex., with Harvey R. Rankin in charge.

Hydraulic Pressed Steel Company, Cleveland, Ohio, announces the consolidation of all of its interests under the name of the Hydraulic Steel Company of Cleveland.

Horace L. Fritschle has been placed in charge of the Chicago office of the Square D Company, at 431 South Dearborn Street, Chicago. Mr. Fritschle was formerly located in St. Louis.

Edward M. Burd and William C. Giffels have opened an engineering office in Grand Rapids, Mich. Both are University of Michigan graduates and were formerly connected with the Consumers' Power Company, in Michigan.

E. P. Palmer, formerly resident engineer of the Rapid Transit Subway Construction Company, has become associated with Warren, Moore & Company, New York City, as engineer directing the company's contracts in the New York territory. As captain of Engineers he served in France in the Transportation Department, A. E. F.

Metal & Thermit Corporation, New York, N. Y., has appointed James G. McCarthy, manager of its Canadian branch, with headquarters in Toronto, and has transferred Robert L. Browne from the New York office to Boston. Mr. Browne is to have charge of sales in New England States.

Clarence Goldsmith, who has been on the engineering staff of the National Board of Fire Underwriters, 76 William Street, New York City, for the past twelve years and late a major in the Construction Division of the United States Army, has been placed in charge of the branch engineering office recently established by the National Board at 234 South La Salle Street, Chicago, Ill.

W. A. Lodge is now connected with the Bussmann Manufacturing Company, St. Louis, Mo., in the capacity of research engineer. He will be in full charge of the engineering department, devoting his time to research and the technical development of the Buss fuse. Mr. Lodge has for the past four years been with the Underwriters' Laboratories of Chicago as research engineer. Previous to his connection with the Underwriters' Laboratories, he was professor of electrical engineering in two universities in the United States and Canada.

Inquiry 32,389.—A firm of merchants in Italy desires to purchase and to secure an agency for the sale of electrical supplies, etc.

Inquiry 32,372.—A company in India desires to be placed in touch with dealers and manufacturers of electrical supplies.

D. & W. Fuse Company's name has been changed to the D. & W. Fuse Works of the General Electric Company, Providence, R. I.

Union Insulating Company, Parkersburg, W. Va., is planning to erect a new plant, 80 ft. x 216 ft., to cost about $100,000.

Hazard Manufacturing Company, Wilkes-Barre, Pa.: A booklet giving a general description of the manufacture of its rubber-insulated wire.

Crescent Insulated Wire & Cable Company, Trenton, N. J., has awarded a contract for a three-story addition to its plant, 50 ft. x 150 ft., on North Olden Avenue, to cost about $40,000.

Westinghouse Lamp Company, New York, N. Y., has awarded a contract for the construction of an extension to its factory at Milwaukee, Wis., to cost about $400,000.

M. B. Austin Company, Chicago, Ill., announces that the Factory Mutuals Fire Insurance Companies have approved Trico renewable fuses in all capacities up to 60 amp., 250 volts.

Ideal Electric & Manufacturing Company, Mansfield, Ohio, is planning to increase its factory facilities materially this summer and to extend its standard line of machines to include also synchronous machines.

Charles F. Overly has recently been appointed general manager of sales of the Structural Tool Company, Cleveland, Ohio. For years Mr. Overly was connected with the manufacture of pneumatic tools and formed the Overly Industrial Tool Company.

W. E. Herring, formerly Pacific Coast industrial agent of the Puget Sound Traction, Light & Power Company, Seattle, Wash., has been transferred to the engineering department in the Boston office of Stone & Webster. Mr. Herring formerly was chief engineer of the United States Forestry Service.

Brown Instrument Company, Philadelphia, Pa., manufacturer of pyrometers, thermometers, tachometers, indicating and recording instruments, is erecting two new buildings, one for the manufacture of recording thermometers, the second for a research department, at a cost of $100,000.

Kentucky-West Virginia Engineering & Electric Company, Ashland, Ky., has been organized to do a general engineering construction business, utilizing an armature and machine shop and engaging in wholesale and retail sales of electric supplies. Thompson Pierce of Bluefield, W. Va., is president; C. Biddison of Ironton, Ohio, vice-president and R. F. Carpenter of Ashland, Ky., secretary and treasurer.

Electrical Manufacturers' Export Corporation, New York, N. Y., was recently incorporated in New Jersey as a holding company of the Electrical Manufacturers' Export Association, a New York association. Capitalization is given as $100,000. The association has offices in fourteen principal cities of both hemispheres and is opening up three more offices. It acts in the interests of American electrical manufacturers only.

Edward P. Sharp, Buffalo, N. Y., manufacturer of the Ideal trolley wheel, has sold the business to L. E. Harmon, who will continue to manufacture the Ideal trolley wheel which was designed, manufactured and sold by Mr. Sharp for the past twenty years. The shop will be moved from its present quarters on Elliott Street to 308-314 Terrace in Buffalo, where better and more suitable quarters have been secured for manufacturing purposes.

Herbert Rice, who has been a member of the sales organization of the Cutter Electrical & Manufacturing Company and who has for some years past been its general sales manager, has resigned to enter the real estate business. Harry F. Darby, who was for many years in charge of the Cutter Company's Chicago office and who more recently has been sales manager of the Ward Electric Vehicle Company, will rejoin the Cutter organization as sales manager with headquarters in Philadelphia. These changes are effective about April 1.

Rome Wire Company, Rome, N. Y., has recently authorized an increase in capital stock to $4,000,000 7 per cent first preferred and $5,650,000 common, the shares in each issue being $100 par value. Kidder, Peabody & Company of New York and Boston are offering to the public $1,400,000 of the preferred issue. The proceeds of the sale of $1,400,000 of preferred stock will furnish additional working capital to care for the growth of the plant in Rome and to pay for plant and carry on the business of the Diamond branch of the Rome Wire Company in Buffalo, N. Y. The total quick assets of the company amount to $3,997,680, and the company's surplus is $2,033,118.

Charles C. Phelps recently became associated with the Uehling Instrument Company, 71 Broadway, New York City, combustion engineer, as well as manufacturer of CO_2 recording equipment and other fuel economy apparatus. He is devoting most of his attention to research work in connection with the efficient combustion of fuel oil in boiler furnaces. Mr. Phelps, a mechanical engineer from the Stevens Institute of Technology, has spent several years studying power-plant problems and for five years of this period he was connected with the Ingersoll-Rand Company, manufacturer of power-plant fective as of April 1.

New Advertising Literature

Star Brass Works, Chicago, Ill., manufacturing engineers, 3114-28 Carroll Avenue, Chicago: A twenty-four-page bulletin, No. 4-A, covering spray-cooling equipment for the cooling of water from steam and ammonia condensers.

Sanford Riley Stoker Company, Worcester, Mass.: A 48-page second edition of its general catalog on "Riley Underfeed Stokers," which describes every phase of stoker operation. Several pages of valuable engineering data are also contributed by the company's service department.

Locomotive Superheater Company, 30 Church Street, New York, N. Y.: Bulletin T-5, covering the use of superheat steam in operating engines and steam turbines. It contains "steam consumption" curves and "superheat" curves for various types of steam prime movers.

Benjamin Electric Manufacturing Company, New York, N. Y.: Bulletin No. 15, describing the Benjamin dome reflector, R-L-M standard, for shop lighting. Bulletin No. 17 covers its different methods of industrial lighting and gives illustrations of its different reflector units, etc.

Green Fuel Economizer Company, Beacon, N. Y.: A 44-page, illustrated bulletin, No. 152, on "Hi-Efficiency, Hi-Speed Radial Flow Fans—Forced Draft Service." The development and design, pressures and capacities developed of these fans are all fully described. Added are twelve pages of dimension sheets and nineteen pages of capacity tables.

Federal Machine & Welder Company, Warren, Ohio: Bulletins describing different types of its welding machinery as follows: Bulletin No. 31 covers Federal electric butt welders, Bulletin No. 32 Federal junior type spot welder, Bulletin No. 33 Federal "Universal" spot welders, Bulletin No. 34 Federal butt welders, and Bulletin No. 35 Federal No. 22-A electric tube welder and roller.

B. F. Sturtevant Company, Hyde Park, Boston.: A sixty-page illustrated catalog, No. 264, covering its motors from fractional-horsepower sizes up to 50 hp. Generators up to 600 kw., steam-turbine sets, gasoline-engine generating sets, commutating pole turbo-generators, inverted rotaries, balancer sets, propeller fans and many special applications of electrical apparatus are illustrated and described.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.: Annual catalog of electrical supplies for 1920. The book is cloth-bound, contains 1,456 pages and is thumb-indexed. A general outline of the company's industrial motors, controllers, railway equipments and power and marine machinery is also included. This catalog replaces all catalogs issued heretofore on details and supplies.

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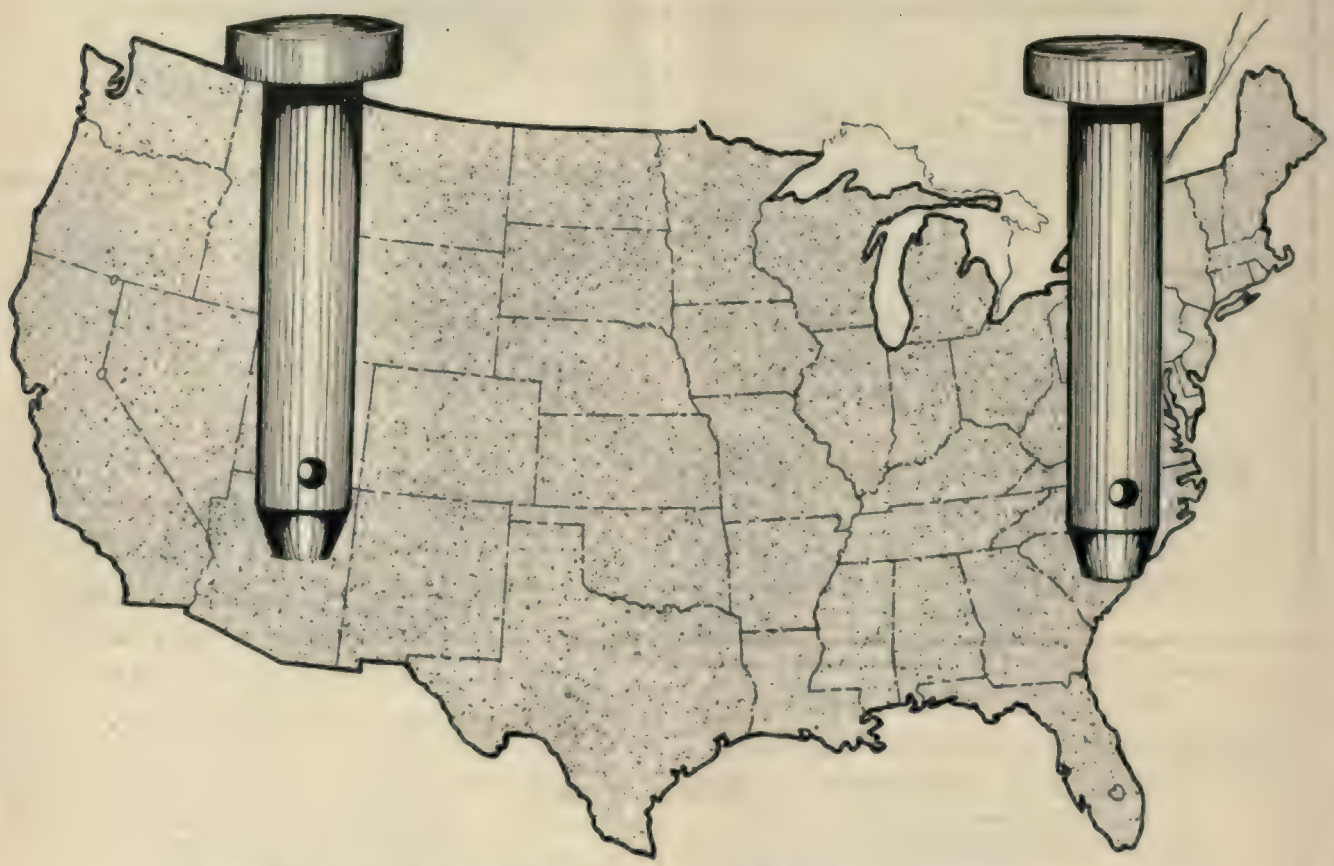
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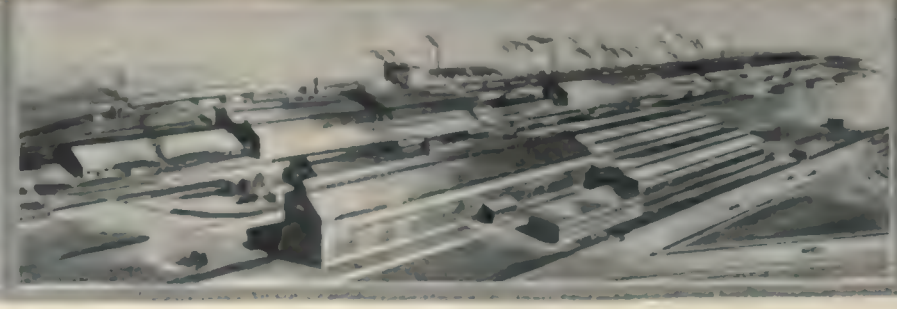
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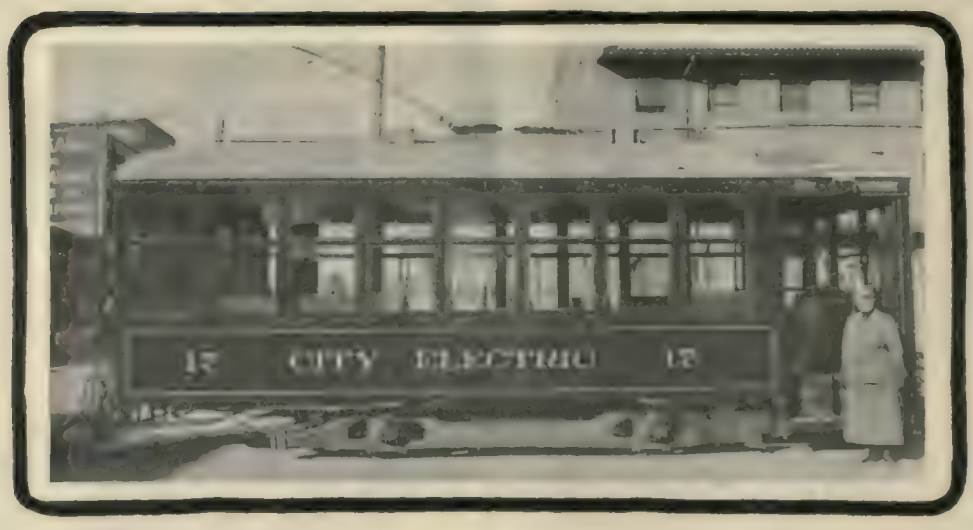
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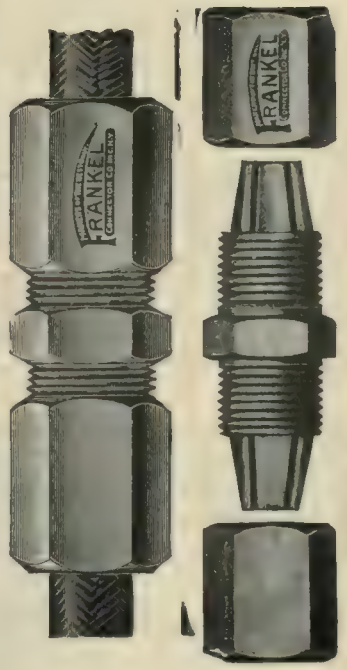
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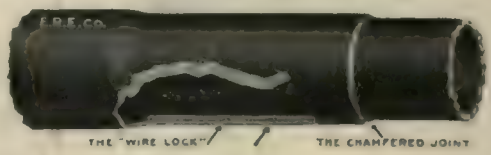
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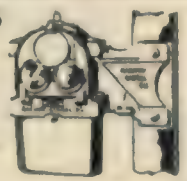
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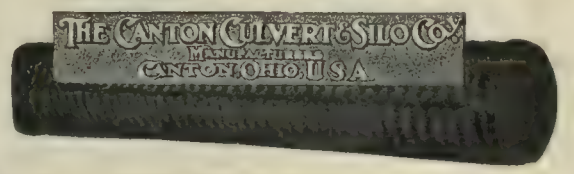
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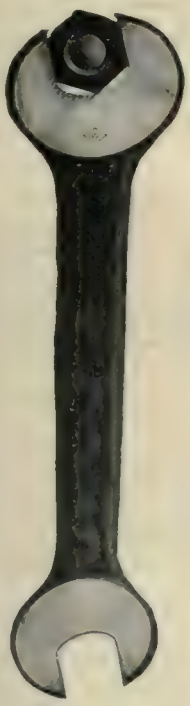
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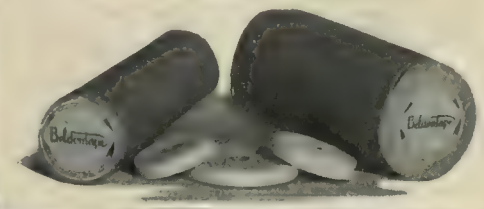
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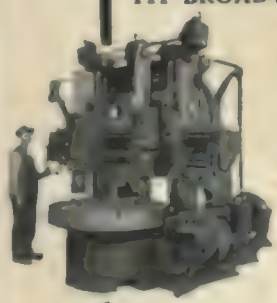
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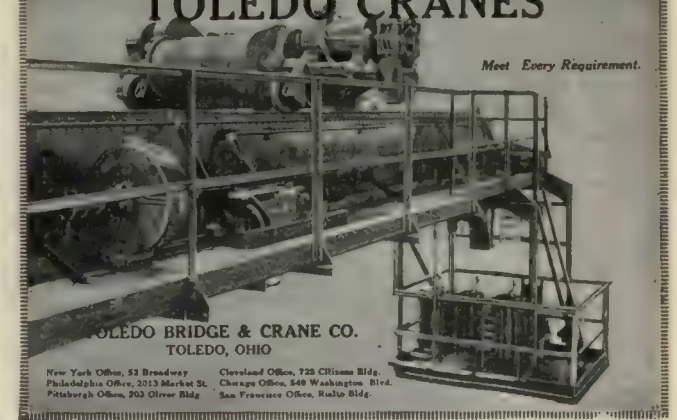
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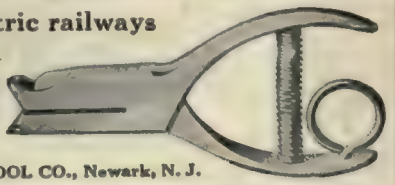
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ARMATURE winders wanted for railway repair shop, vicinity of Chicago, experience on heavy bar wound armatures desirable, but not essential. Give full information, including past experience and when available. Address, P-627, Elec. Ry. Journal, Old Colony Bldg., Chicago.

A COMPETENT track foreman wanted immediately: Must be experienced in street railway work, including electric welding and track bonding. Give experience, references, photograph, salary desired and all necessary information in first letter. Galesburg & Kewanee Electric Railway Company, Kewanee, Illinois.

DRAFTSMAN wanted: Must be capable of designing, computing and laying out special track work for electric and steam railroads; must be quick, accurate and experienced in this line. Give full particulars with reply and state salary expected. New York Switch & Crossing Co., 15th and Madison Sts., Hoboken, N. J.

ELECTRICAL draftsmen wanted; several, by large construction firm building power stations in Central West. Will pay $1,800 to $2,400 for men with experience in electrical design in connection with power stations, according to ability. Address, giving age, education, experience and salary expected. P-610, Elec. Ry. Journal, Old Colony Bldg., Chicago.

ELECTRICAL engineer wanted, technical graduate with good broad practical experience, electric line maintenance and construction, both A. C. and D. C. as well as experienced power plant operation, a knowledge of street railway construction and operation, is very desirable. Must possess managerial and executive ability as position holds a very good future. In reply give age, experience, references and salary desired. P-620, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

ELECTRICAL engineer wanted, with some experience in street railway work, in city in Middle West. State experience, references, and salary desired when replying. P-605, Elec Ry. Journal, Old Colony Bldg., Chicago.

EXPERIENCED traffic man wanted. Must understand traffic analyses, schedule making, and be able to take full charge of traffic department for large company. Technical man preferred. P-616, Elec. Ry. Journal, Old Colony Bldg., Chicago.

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2—Painters
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POSITIONS VACANT

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FIRST-CLASS draftsmen wanted, and estimators familiar with steam and electric railway passenger equipment, by large manufacturing concern in the East. P-622, Elec. Ry. Journal.

GENERAL bookkeeper wanted thoroughly experienced in street railway, gas and electric light accounting, and capable of taking charge of the general books of a large public utility company in Middle West. Will pay $200 per month to right man. P-628, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

GENERAL superintendent wanted, experienced in construction and operation of street railway properties as well as lighting and power. Must have good broad experience covering these lines and possess magagerial and executive ability for operating property of about 100 miles street railway and 10,000 light and power consumers. Good future for right person possessing the above qualities. In reply give age, experience, salary desired, when could report for work as well as for interview. P-621, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

INSPECTION barn foreman for city system operating about one hundred cars. Must have thorough practical knowledge of modern equipment and be able to supervise and get results from the inspection forces. Permanent position with excellent opportunity for future. Address reply containing full particulars to P 559, Elec Ry Journal.

MAN experienced in direct current wanted, trolley and overhead maintenance and construction work. A knowledge of A. C. maintenance and construction desirable but not essential. Man with broad experience and initiative capable of developing into general foreman wanted. In reply give full particulars of experience, salary desired when could report for work. P-619, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

POSITIONS WANTED

AUDITOR, broad experience in utility accounting and finance, competent executive. A1 credentials. PW-625, Elec. Ry Journal.

AUDITOR specialist for rehabilitating traction properties solicits connection with large company; reference present employer. PW-626, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

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ALLROUND shop man wants position that will be permanent. Have had experience as shop foreman. Address PW-617, Elec. Ry. Journal, Old Colony Bldg., Chicago.

EXECUTIVE position by expert operating or transportation man; 15 years' experience in transportation and mechanical departments; also 3 years steam railroad work. Age 35. Will consider any location with future. References A-1. Address 104 N. Third St., Columbus, Ohio. Henry Whisner.

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MASTER mechanic wishes to make a change; have had 16 years' experience on maintenance and construction in all its branches. At present employed as master mechanic by a road operating from 60 to 70 cars. Can furnish A1 reference from last and present employers. PW-614, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

STOREKEEPER, age thirty, desires change. Seven years' experience in all branches. Ability to assume full charge. Address PW-623, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

SUPERINTENDENT age thirty-six, desires change, fourteen years experience in operation and maintenance electric railway and lighting properties; thoroughly familiar with modern, and economical methods. Reference present and past employers. PW-630 Electric Railway Journal 935 Real Estate Trust Bldg., Phila

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LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST, 24, 1912

Of Electric Railway Journal, published weekly at New York, N. Y., for April 1, 1920.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared James H. McGraw, Jr., who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Co., Publisher of Electric Railway Journal, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Co., Inc., 10th Ave. and 36th St., New York, N. Y.; Editor, Henry W. Blake, 10th Ave. at 36th St., New York, N. Y.; Managing Editor (none); Business Manager, J. E. Mason, 10th Ave. at 36th St., New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.) McGraw-Hill Co., Inc., 10th Ave. at 36th St., New York, N. Y.; James H. McGraw, 10th Ave. at 36th St., New York, N. Y.; Arthur J. Baldwin, 10th Ave. at 36th St., New York, N. Y.; John McGhie, 10th Ave. at 36th St., New York, N. Y.; Fred Low, 10th Ave. at 36th St., New York, N. Y.; Henry W. Blake, 10th Ave. at 36th St., New York, N. Y.; Leonard D. Baldwin, 27 Pine St., New York, N. Y.; F. S. Weatherby, 163 Clinton Rd., Brookline, Mass. Arthur J. Baldwin, Trustee, 10th Ave. at 36th St., New York, N. Y., for Estate of John A. Hill. Arthur J. Baldwin, Trustee, 10th Ave. at 36th St., New York, N. Y., for Donald Baldwin. Arthur J. Baldwin, Trustee, 10th Ave. at 36th St., New York, N. Y., for Franklin Baldwin, Grace Baldwin and Cynthia Haselton.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only.)

McGRAW-HILL COMPANY, Inc.
J. H. McGRAW, JR.,
Secretary.

Sworn to and subscribed before me this 26th day of March, 1920.
MARTIN J. WIEMER.
Notary Public.

[Seal] Kings County Certificate No. 103. Certificate filed in New York County No. 316. (My commission expires March 30, 1920.)

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4 W. H. 93 Solid Gears	3	5	4½	63	
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2 W. H. 93 Solid Gears	3	5	4-7/16	63	
1 W. H. 93 Split Gears	3	5	4½	63	
2 W. H. 101 B Solid Gears	3	5	4½	62	
3 W. H. 101 B Split Gears	3	5	4½	62	New
1 W. H. 101 B Solid Gears	3	5	4-7/16	62	
2 W. H. 56 Split Gears	3	5	4½	58	
5 W. H. 56 Solid Gears	3	5	3¼	58	New
1 G. E. 1000 Solid Gears	3	4½	4	69	New
1 G. E. 80 Split Gears	3	5	4½	69	New
1 Split Gear	3	4½	3¾	67	
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Also large tonnage of steel rails of most all sections.

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about 42 ft. over all, in first-class condition with trucks, 33-in. wheels, without motors, but with controllers and cables.

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L. B. FOSTER COMPANY
Park Building, Pittsburgh, Pa.
Tribune Building, 154 Nassau St., New York, N. Y.

Machinery in Stock for *Immediate Shipment*

ROTARY CONVERTERS
2—300 kw., Westg., 3-phase, 60-cycle, 370-v., A.C., 575-v., D.C., 600 r.p.m.
2—200 kw., G.E., 3-phase, 25-cycle, 85-v., A.C., 125-v., D.C., 8 pole, 375 r.p.m.
1—150 kw., Westg., 2- or 3-phase, 60-cycle, 185-v., A.C., 250-v., D.C., 720 r.p.m.

FREQUENCY CHANGER SET
1—600 kva., Allis-Chalmers Frequency Changer Set, 300 r.p.m., 3-phase, 60-cycle, 2300-v. one end, 3-phase, 6600-v., 25-cycle on other end.

ARCHER & BALDWIN, INC.
114-118 Liberty Street, New York City
Telephone 4337-4338 Rector

Advertisements for the
Searchlight Section



Can be received at the New York Office of Electric Railway Journal until 10 a.m.

Thursday

For Issue out Saturday

0141

RAILS

New			Relay		
2000	tons	100's	350	tons	100's
1800	tons	90's	400	tons	85's
700	tons	85's	300	tons	75's
430	tons	80's	1200	tons	70's
200	tons	75's	800	tons	65's
240	tons	70's	1500	tons	60's
85	tons	65's	4000	tons	56's
500	tons	60's	1100	tons	50's
100	tons	40's	200	tons	45's
20	tons	30's	2000	tons	40's
100	tons	24's	650	tons	35's
330	tons	20's	430	tons	30's
150	tons	16's	230	tons	25's
120	tons	12's	340	tons	20's
17	tons	8's			

10 tons, 7 inch, 70 lb., Shanghai.
110 tons, 9 inch, 90 lb., Grooved Girder.

Good Stock *Prompt Shipment*

ZELNICKER IN ST. LOUIS

Get our new 100 page bargain bulletin No. 280 for exceptional offering in Cars, Locomotives, new and used Switch Material, Angle Bars, Tie Plates, Rail Braces, Pipe, Piling, Tanks, Engines, Generators, Rollers, Machine Tools, etc.

FOR SALE

4—Center Entrance, All-Steel Cars, Plain Arch Roof, 35 ft. over bumpers, Taylor Double Trucks.

2—G.E. 247-A Box Frame Motors.
2—K-10-P Controllers.

Complete. Splendid Condition. Full details upon request.

ELECTRIC EQUIPMENT COMPANY
Commonwealth Bldg. Philadelphia Pa

Caution—RAIL USERS

If you contemplate needing more track during 1920, BUY NOW. There will be a SCARCITY. We own and offer the following NEW RAILS for prompt shipment:

New 12-lb. Rails, splices, bolts and nuts.
New 30-lb. Rails, angle bars, bolts and nuts.
70-lb. ASCE Relayers.
New 80-lb. Rails, angle bars, bolts, nuts and spikes.
New 90-lb. Rails, angle bars, bolts, nuts and spikes.

They will be gone soon. Write or wire for our quotations.

HYMAN-MICHAELS COMPANY
531 Peoples Gas Bldg., Chicago

BRANCH OFFICES: First National Bank Bldg., Pittsburgh, Pa.; Railway Exchange Bldg., St. Louis, Mo.; East Chicago, Ind.
YARDS AND WAREHOUSES: East Chicago, Ind. and St. Louis, Mo.

WORRYLESS ELECTRICAL REPAIRS

On all kinds and sizes A.C. or D.C. motors and generators, starters, welders, controllers or anything electrical. Quick shipment from stock material of coils, commutators—shafts—bearings etc. Remember our initials stand for our product.

CAREFUL CLEVELAND ARMATURE WORRYLESS WORKS, Inc.

EST. 1895 4732-4-6 ST. CLAIR AVE., CLEVELAND INC. 1918

Electric Railway for Sale!

We have purchased the entire equipment of the Cincinnati & Columbus Traction Co., which was operated from Norwood to Hillsboro, O., a distance of approximately 53 miles, and offer for sale the following:

RAILS—

4000 tons No. 1, 70-lb. relaying steel rails.

WIRE—

500,000 lb. or more of copper trolley, feeder, high tension, etc.

POWER EQUIPMENT—

6—Babcock & Wilcox Boilers, 165-lb. pressure, equipped with American Stokers, forced and induced draft, and economizers.
2—Corliss Engines.
Generators.
Switchboards and Transformers.
2—Rotary Converters.

ROLLING STOCK (Standard Gauge)—

Suitable for Industrials only.
5—Box Cars.
3—Flat Cars.
1—Derrick Car.
5—Gondolas.
3—Gondola Cars, Center Dump.

A number of all steel Bridges for quick acceptance at $1.00 per 100 lbs. as is

Write or wire us, stating just what you are interested in, and we will be pleased to submit quotations and further particulars.

HYMAN-MICHAELS COMPANY

(Refer to Department J)

People's Gas Building, Chicago, Ill.

Branches: New York City—Pittsburgh—St. Louis

War Department

Corps of Engineers

Offers for sale new

RAIL & ACCESSORIES

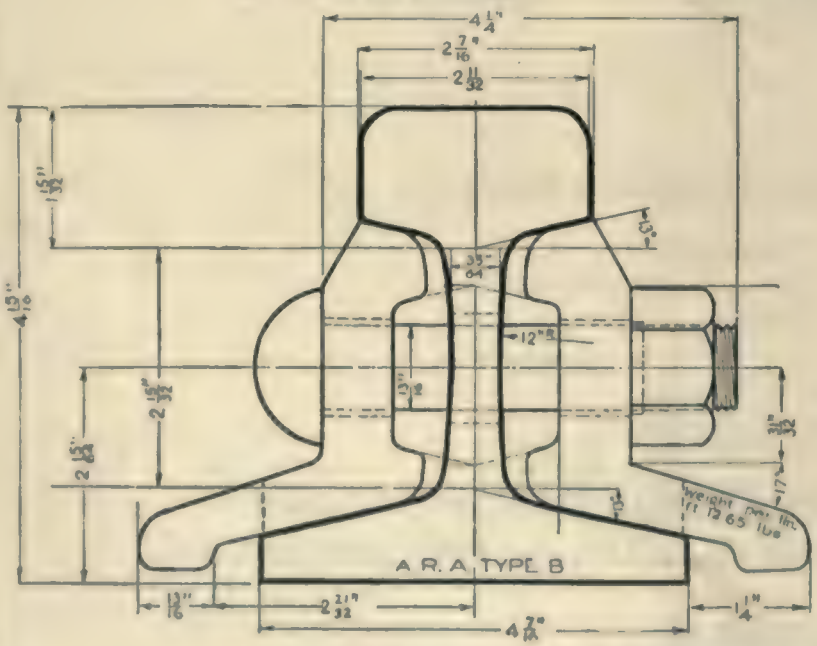
What is Offered for Sale:

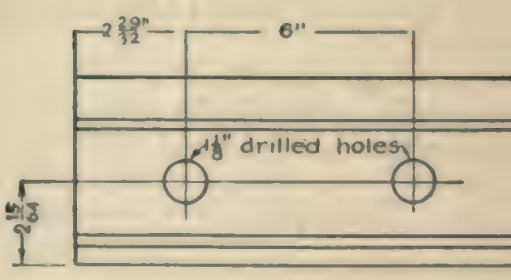
The War Department, Corps of Engineers, offers for sale the Surplus Track Material, details of which are given in this advertisement.

80 LB. A.R.A. "TYPE B" RAIL

Approximately 62,490 gross tons—drilled—standard lengths

28,164 Gross Tons in storage at.....Norfolk, Va.
30,624 Gross Tons in storage at.....Kearny, N. J.
3,363 Gross Tons in storage at.....Philadelphia, Pa. (21st St. and Oregon Ave.)
269 Gross Tons in storage at.....Port Newark, N. J.
42 Gross Tons in storage at.....(Army Reserve Depot) New Cumberland, Pa.
28 Gross Tons in storage at.....(Army Reserve Depot) Columbus, O.





80 LB. A.R.A. "TYPE B" RAIL

Approximately 700 gross tons—undrilled—standard lengths

In Storage at Norfolk, Va.

NOTE—This item must be bid for separately from other 80-lb. rails. Accessories can be furnished for this tonnage of rail if drilled by purchaser to suit punching of splice bars.

For Conditions of Sale see last page of this advertisement

War Department
Corps of Engineers
and unused surplus
—TRACK APPLIANCES

U.S. CORPS OF ENGINEERS

Prompt Delivery—Inspection Invited

Accessories for 80 lb. Rail

254,139 Pairs Splice Bars for 80-Lb. A.R.A. Type "B" Rail

179,800 Pairs in storage at.....Norfolk, Va.
53,418 Pairs in storeg at.....Kearny, N. J.
18,428 Pairs in storage at.....Columbus, O.
1,955 Pairs in storage at.....Port Newark, N. J.
538 Pairs in storage at.....Schenectady, N. Y. (Army Reserve Depot)

Details of drilling of rail and punching of splice bars are shown in cut.

8,257 Kegs (200 Lb. Per Keg) Track Bolts and Nuts—Size 7/8 In. x 4 1/4 In.

7,410 Kegs in storage at.....Norfolk, Va.
546 Kegs in storage at.....Kearny, N. J.
301 Kegs in storage at.....New Cumberland, Pa.

20,661 Kegs (200 Lb. Per Keg) Track Spikes—Size 9/16 In. x 5 1/2 In.

20,217 Kegs in storage at.....Norfolk, Va.
10 Kegs in storage at.....New Cumberland, Pa
434 Kegs in storage at.....Columbus, Ohio

70-Lb. A.S.C.E. Rail

7 Gross Tons in standard lengths, drilled. No accessories. In storage at Kearny, N. J.

CONDITION—Poor.

60-Lb. A.S.C.E. Rail

230 Gross Tons in standard lengths, drilled. No accessories. In storage at Norfolk, Va. (Portlock Yards).

CONDITION—Poor.

40-Lb. A.S.C.E. Rail

10 Gross Tons in standard lengths, drilled. No accessories. In storage at Kearny, N. J.

CONDITION—Poor.

QUANTITY: All quantities shown are approximate only.

QUALITY: No distinction can be made between Open Hearth or Bessemer quality nor can any specific information be given in regard to the specifications under which this material was manufactured. All the material listed was originally inspected for the Government by either R. W. Hunt and Company or by the Pittsburgh Testing Laboratory.

CONDITION: All of the material offered for sale is new and unused but has been in open storage. Condition is FAIR unless otherwise stated.

INSPECTION INVITED

ALL MATERIAL IS SOLD "AS IS." It may be inspected by authorized representative of the prospective bidder upon application to the Officer in Charge at Point of Storage. No inspection will be allowed after sale is consummated except to verify count.

DELIVERY: Delivery can begin promptly after contract is executed. Delivery to be f.o.b. cars at storage point, except that material stored at Kearny, N. J. and Norfolk, Va., can be delivered f.o.b. or f.a.s. at option of purchaser.

For detail of Track Appliances see next page

War Department

Corps of Engineers

offers for sale new

RAIL & ACCESSORIES

64,500 Pieces Tie Plates, 6½ In. x 10 In., for Use With 80-Lb. A. R. A. Type "B" Rails. In Storage at Norfolk, Va.

125,192 Pieces, Rail Braces, for Use with 80-Lb. A. R. A. Type "B" Rail. In Storage at Norfolk, Va.

2,570 Switch Lamps—Adams & Westlake No. 175½. In Storage at Kearny, N. J.

***Condition:* Good**

5,170 New Century Switch Stands

1,500 Switch Stands in storage at....Norfolk, Va.
1,979 Switch Stands in storage at..Kearny, N. J.
1,611 Switch Stands in storage at New Cumberland, Pa.
80 Switch Stands in storage at Schnectady, N. Y.

6,246 No. 8 Turnouts, Consisting of Com- plete Switch, Frog and Guard Rails, Made of 80-Lb. A. R. A. Type "B" Rail

3,700 Turnouts in storage at Norfolk, Va.
2,300 Turnouts in storage at Kearny, N. J.
240 Turnouts in storage at Chicago, Ill. (Pullman Storage Depot).
6 Turnouts in storage at Schenectady, N. Y. (Army Reserve Depot)

156 No. 8 Single Slip Switches

Made of 80-lb. A.R.A. Type "B" rail.
119 Single Slip Switches in storage at Norfolk, Va.
37 Single Slip Switches in storage at Kearny, N. J.

135 No. 8 Double Slip Switches

Made of 80-lb. A.R.A. Type "B" rail.
107 Double Slip Switches in storage at Norfolk, Va.
28 Double Slip Switches in storage at Kearny, N. J.

103 Railroad Crossings—made of 80 lb. A.R.A. Type "B" Rail

(pa) Gauge 4 ft. 8-11/16 in. x 4 ft. 8 11/16 in.
Angle 90°—2 crossings in storage at Kearny, N. J.
Angle 75°—10 crossings in storage at Norfolk, Va.
Angle 60°—10 crossings in storage at Norfolk, Va.
Angle 30°—10 crossings in storage at Norfolk, Va.

(pb) Gauge 4 ft. 8½ in. x 4 ft. 8½ in.

Angle 75°—18 crossings in storage at Norfolk, Va.

Angle 60°—12 crossings in storage at Norfolk, Va.

Angle 45°—15 crossings in storage at Kearny, N. J.

(pc) Gauge 4 ft. 8 11/16 in. x 60 c. m.

Angle 90°—14 crossings in storage at Norfolk, Va.

Angle 60°—9 crossings in storage at Kearny, N. J.

Angle 45°—3 crossings in storage at Kearny, N. J.

For Conditions of Sale see opposite page

War Department
Corps of Engineers
and unused surplus
—TRACK APPLIANCES

U.S. CORPS OF ENGINEERS

Here are the Conditions of Sale:

There is nothing complicated about submitting bids. No special form is required. Read carefully the following conditions of sale as to quantities upon which bids will be accepted and as to how, when and where to submit your bids.

QUANTITIES UPON WHICH BIDS WILL BE ACCEPTED

BIDS FOR 80 LB. A.R.A. TYPE "B" RAIL may be for a car load lot or multiple thereof or for the entire quantity offered. Bids for the entire quantity, however will receive preferred consideration. All bids for 80 lb. A.R.A. Type "B" rail must include the proportionate quantity of accessories computed in accordance with the following table:

Rail	1,000 gross tons
Splice Bars	2,6773 Pairs
Track Bolts and Nuts	67.88 Kegs (200 lb. per keg)
Track Spikes	329.44 Kegs (200 lb. per keg)

ALL BIDS FOR 80 LB. A.R.A. TYPE "B" RAIL AND ACCESSORIES must show the price per ton for rail; price per pair or per cwt. for splice bars; price per keg or per cwt. for track bolts and nuts, and track spikes.

Bids for track appliances may be for all or any part of the listed quantity and must show the price per unit as listed.

HOW, WHEN AND WHERE TO SUBMIT BIDS

Make your bid on any form convenient to you. Place it ina sealed envelope. On both sides of this envelope write "SEALED BID on Track Material, to be opened April 26th." Enclose this sealed envelope in another and mail to Chief of Engineers, Room 2821, Muniitons Building, Washington, D. C.

All bids must be in the Office, Chief of Engineers not later than 3:00 P.M., APRIL 26th, 1920.

The Chief of Engineers reserves the right to reject any or all bids.

TERMS—All offeres must contemplate the payment by certified check as follows: 5% at the signing of the contract. This amount to apply as final payment on last shipment of material. Certified check for payment of each shipment of material to be remitted by the purchaser upon presentation of certified invoice and shipping order. Complt shipping instrucetions must be furnished by the urchaser within 180 days of the notce of award.

Any additional information desired may be obtained upon application to the Office, Chief of Engineers, Room 2821, Munitions Building, Washington, D. C.

Office, Chief of Engineers
Room 2821 Munitions Building
Washington, D. C.

For details about rails see first page of this advertisement

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

Advertising, Street Car
Collier, Inc., Barron G.

Air Aftercoolers
Ingersoll-Rand Co.

Air Receivers
Ingersoll-Rand Co.

Ammeters
Weston Elec'l Instrument Co.

Anchors, Guy
Chance Co., The.
Electric Service Supplies Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Westinghouse Elec. & M. Co.

Angle Bars
Lackawanna Steel Co.

Ash Storage Tanks, Cast Iron
Green Engineering Company

Automobiles and Buses
Brill Co., The J. G.

Axle Straighteners
Columbia M. W. & M. I. Co.

Axles, Car Wheel
Bemis Car Truck Co.
Brill Co., The J. G.
Carnegie Steel Co.
Cambria Steel Co.
Midvale Steel & Ordnance Co.
St. Louis Car Co.
Standard Steel Works Co.
Westinghouse Elec. & M. Co.

Babbitt Metal
More-Jones Brass & Metal Co.

Babbitting Devices
Columbia M. W. & M. I. Co.

Badges and Buttons
Electric Service Supplies Co.
International Register Co., The

Batteries, Storage
Electric Storage Battery Co.

Bearings and Bearing Metals
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
More-Jones Brass & Metal Co.
St. Louis Car Co.
Westinghouse Elec. & M. Co.

Bearings, Center and Roller Side
Stucki Co., A.

Bearings, Roller & Ball
Gurney Ball Bearing Co.

Bells and Gongs
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co
St. Louis Car Co.

Benders, Rail
Niles-Bement-Pond Co.
Zelnicker, Walter A., Supply Co., Inc.

Boiler Cleaning Compounds
Johns-Manville Co., H. W.

Boiler Coverings
Johns-Manville Co., H. W.

Boilers
Babcock & Wilcox Co.

Boiler Tubes
National Tube Co.

Bond Testers
American Steel & Wire Co

Bonding Apparatus
American Steel & Wire Co.
Electric Railway Improv. Co.
Electric Service Supplies Co.
Ohio Brass Co.

Bonds, Rail
Electric Railway Improv. Co.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & M. Co

Boring Tools, Car Wheel
Niles-Bement-Pond Co.

Brackets and Cross Arms. (See also Poles, Ties, Posts, Etc.)
Bates Expanded Steel Truss Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Hubbard & Co.
Lindsley Bros. Co.
Ohio Brass Co.

Brake Adjusters
National Ry. Appliance Co.
Westinghouse Traction Brake Co.

Brake Shoes
Amer. Brake Shoe & Fdry. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
St. Louis Car Co.

Brakes, Brake Systems and Brake Parts
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
General Electric Co.
National Brake Co.
St. Louis Car Co.
Safety Car Devices Co.
Westinghouse Traction Brake Co.

Bricks, Fire
Green Engingering Co.

Brooms, Track, Steel or Rattan
Zelnicker, Walter A., Supply Co., Inc.

Brushes, Carbon
General Electric Co.
Jeandron, W. J.
United States Graphite Co.
Westinghouse Elec. & M. Co.

Brushes, Graphite
United States Graphite Co.

Brush Holders
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.

Bushings, Case Hardened and Manganese
Bemis Car Truck Co.

Bushings, Graphite and Wooden Bound Brook Oilless Bearing Co.

Cables. (See Wires and Cables)

Carbon Brushes. (See Brushes, Carbon)

Car Equipment. (For Fenders, Heaters, Registers, Wheels, etc., see those headings)

Car Trimmings. (For Curtains, Registers, Doors, Seats, etc., see those headings)

Car Panel Safety Switches
Westinghouse Elec. & Mfg. Co.

Cars, Passenger, Freight, Express, etc.
American Car Co.
Brill Co., The J. G.
Cambria Steel Co.
Kuhlman Car Co., G. C.
McGuire-Cummings Mfg. Co.
Midvale Steel & Ordnance Co.
National Ry. Appliance Co.
St. Louis Car Co.
Wason Mfg. Co.

Cars, Second Hand
Electric Equipment Co.

Car, Self-Propelled
Electric Storage Battery Co.
General Electric Co.

Castings, Brass, Composition or Copper
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.
More-Jones Brass & Metal Co.

Castings, Gray Iron and Steel
American Steel Foundries
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Standard Steel Works Co.

Castings, Malleable and Brass
Amer. Brake Shoe & Fdry. Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.

Catchers and Retrievers, Trolley
Electric Service Supplies Co.
Ohio Brass Co.
Wood Co., Chas. N.

Ceiling, Car
Pantasote Co.

Circuit Breakers
Automatic Reclosing Circuit Breaker Co.
Cutter Electrical & Mfg. Co., The
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps and Connectors for Wires and Cables
Anderson Mfg. Co., A. & J. M.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Cleaners and Scrapers—Track (See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.
Ohio Brass Co.

Clusters and Sockets
General Electric Co.

Coal and Ash Handling. (See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Coils, Armature and Field
Cleveland Armature Works
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Rome Wire Co.
Westinghouse Elec. & M. Co.

Coils, Choke and Kicking
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & M. Co.

Coin-Counting Machines
Electric Service Supplies Co.
International Register Co., The
Johnson Fare Box Co.

Comelong
Bush Electric Co.

Commutator Slotters
Electric Service Supplies Co
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Commutator Truing Devices
General Electric Co.

Commutator or Parts
Cameron Electrical Mfg. Co
Cleveland Armature Works
Columbia M. W. & M. I. Co.
Eureka Co
General Electric Co.
Westinghouse Elec. & Mfg Co

Compressors, Air
Chicago Pneumatic Tool Co.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Trac. Brake Co.

Compressors, Gas
Ingersoll-Rand Co

Condensers
General Electric Co.
Westinghouse Elec. & Mfg. Co

Conduit Fittings
Chicago Fuse Mfg. Co.

Connectors, Solderless
Frankel Connector Co.
Westinghouse Elec. & Mfg. Co.

Controller Fingers
Russell Mfg. Co.

Controllers or Parts
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Johns-Manville Co., H. W.
Russell Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Controller Regulators
Elec. Service Supplies Co.

Controlling Systems
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Converters, Rotary
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Conveyors, Belt
Portable Machinery Co.

Conveyors, Coal and Ash
Green Eng. Co.
Portable Machinery Co.

Conveyors, Portable
Portable Machinery Co.

Conveying and Hoisting Machinery
Columbia M. W. & M. I. Co.
Green Eng. Co.
Portable Machinery Co.

Copper Wire
Anaconda Copper Mining Co.

Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Roebling's Sons Co., John A.
Samson Cordage Works

Cord Connectors and Couplers
Electric Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.

Couplers, Car
Brill Co., The J. G.
Ohio Brass Co.
Van Dorn Coupler Co.
Westinghouse Trac. Brake Co.

Cranes
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The

Creosoting. (See Wood Preservatives)

Cross Arms. (See Brackets)

Crossing Foundations
International Steel Tie Co.

Crossing Signals. (See Signals, Crossing)

Crossings, Frog & Switch
Wharton, Jr. & Co., Wm

Crossings, Track. (See Track, Special Work)

Culverts
Canton Culvert & Silo Co.

Curtains and Curtain Fixtures
Brill Co., The J. G.
Electric Service Supplies Co.
Pantasote Co.
St. Louis Car Co.

Cutouts
Chicago Fuse Mfg. Co

Dealers' Machinery
Archer & Baldwin
Cleveland Armature Works
Electric Equipment Co.
Foster Co., L. B.
Griswold Machine Co., Geo. M.
Hyman Michaels Co.
MacGovern & Co., Inc.
Zelnicker Supply Co., Inc., Walter A.

Derailing Devices. (See also Track Work)
Cleveland Frog & Crossing Co.

Destination Signs
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Detective Service
Wish Service P. Edward

On Guard!



Where Extreme Reliability Is Essential

The development of the electrification of railroads has been made possible by the perfection of the art of electrical measurement. This Company originated the art as it is known and practiced today, and practically every improvement has emanated from this source. That is why

Weston

Alternating Current Switchboard Instruments

are on guard over so many electric railway power plants, insuring the most efficient control and usage of the electrical machinery and the most accurate supervision of power distribution.

Model 167 Wattmeter, one of the remarkable group of Switchboard Instruments supplied by this Company, is herewith illustrated.

Write us for catalogs or bulletins, specifying the field that interests you.

Weston Electrical Instrument Co.
21 Weston Ave., Newark, N. J.

WHAT AND WHERE TO BUY

Dogs, Lathe
Williams & Co., J. H.

Door Operating Devices
Consolidated Car Heating Co.
National Pneumatic Co., Inc.
Safety Car Devices Co.

Doors, Asbestos
Johns-Manville Co., H. W.

Doors and Door Fixtures
Brill Co., The J. G.
General Electric Co.
Hale & Kilburn Corp.

Doors, Folding Vestibule
National Pneumatic Co., Inc.

Draft Rigging. (See Couplers)

Drills, Rock
Ingersoll-Rand Co.

Drills, Track
American Steel & Wire Co.
Chicago Pneumatic Tool Co.
Electric Service Supplies Co.
Niles-Bement-Pond Co.
Ohio Brass Co.

Drinking Cups, Sanitary Paper
Individual Drinking Cup Co., Inc.

Dryers, Sand
Electric Service Supplies Co.
Zelnicker Supply Co., Inc., Walter A.

Electrical Wires and Cables
Roebling's Sons Co., J. A.

Engineers, Consulting, Contracting and Operating
Archbold-Brady Co.
Arnold Co., The
Bylesby Engineering & Management Corp'n
Clark Management Corp., E. W.
Engel & Bevenor
Feustel, Robert M.
Ford, Bacon & Davis
Hoist, Englehardt W.
Jacobs & Co., J. L.
Kelly Cooke & Co.
Republic Engineers, Inc.
Richey, Albert S.
Robinson & Co., Dwight P.
Sanderson & Porter
Scofield Engineering Co.
Stone & Webster
White Engineering Corp., The J.G.

Engines, Gas and Oil
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Engines, Steam
Westinghouse Elec. & Mfg. Co.

Fare Boxes
Brill Co., The J. G.
Cleveland Fare Box Co.
Johnson Fare Box Co.
National Railway Appliance Co.

Fences, Woven Wire and Fence Posts
American Steel & Wire Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Cleveland Fare Box Co.
Consolidated Car Fender Co.
Electric Service Supplies Co.
Star Brass Works

Fibre and Fibre Tubing
Johns-Manville Co., H. W.
Westinghouse Elec. & Mfg. Co.

Field Coils. (See Coils)

Filters, Water
Scaife & Sons Co., Wm. B.

Fire Extinguishing Apparatus
Castle, Inc., James M.
Johns-Manville Co., H. W.

Fireproofing Material
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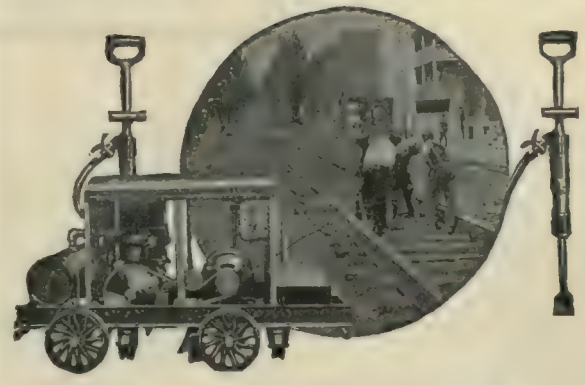
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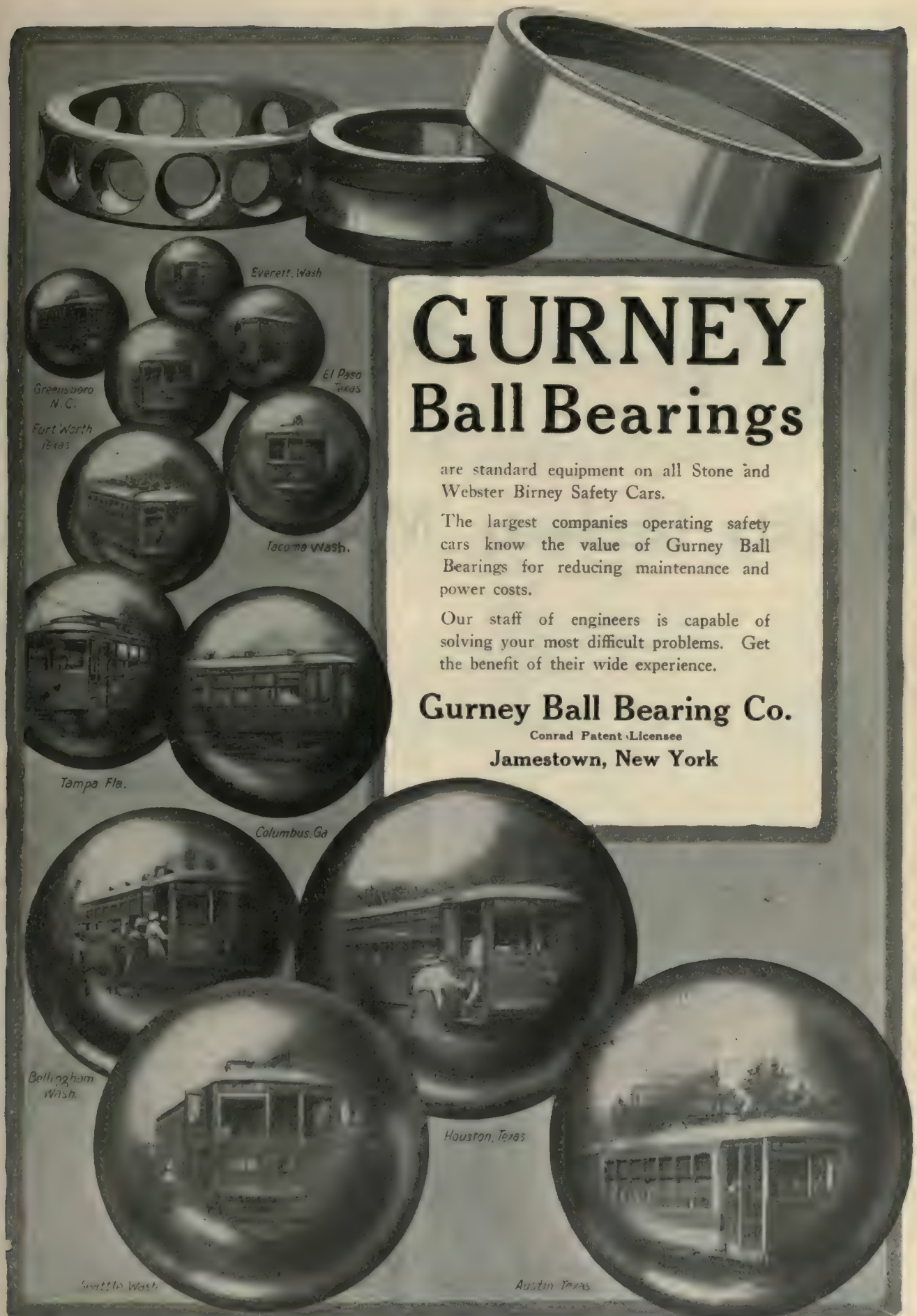
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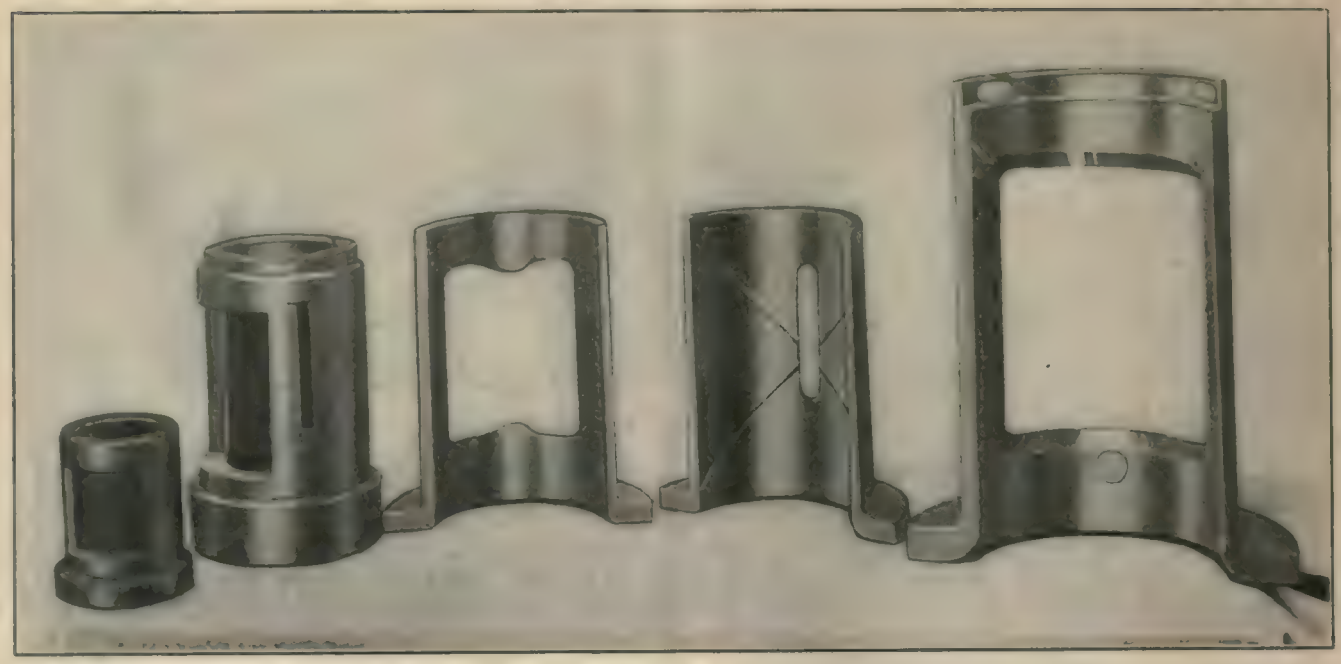
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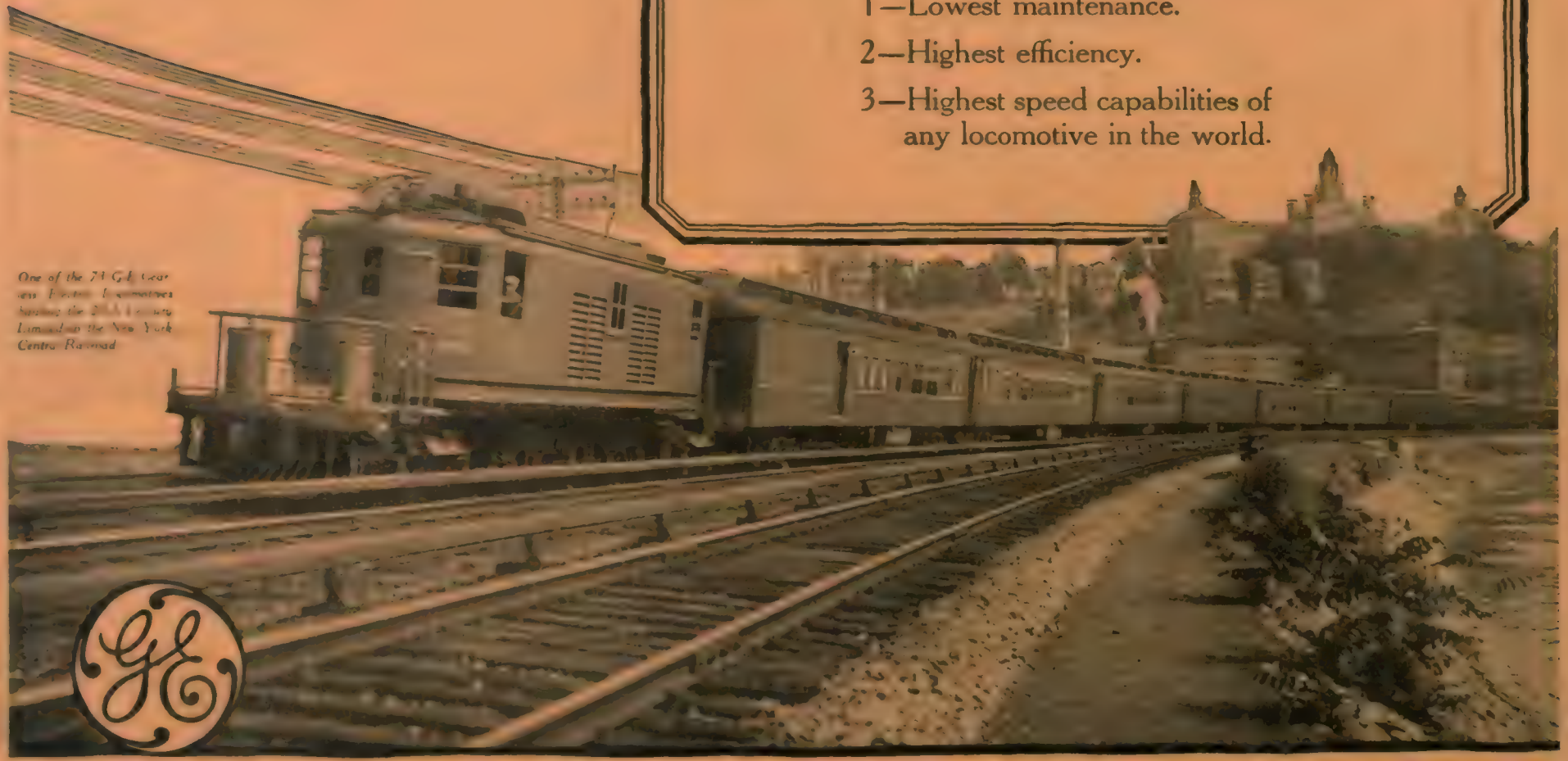
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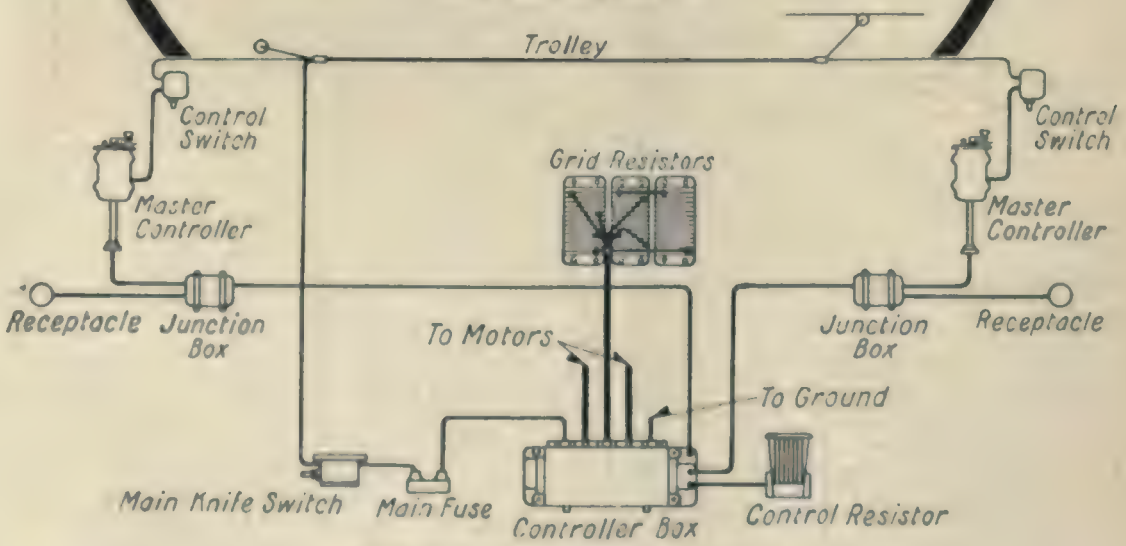
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Westinghouse

Vol. 55, No. 16 New York, April 17, 1920 *Pages 785-838*

Electric Railway Journal

H. W. BLAKE, *Editor*

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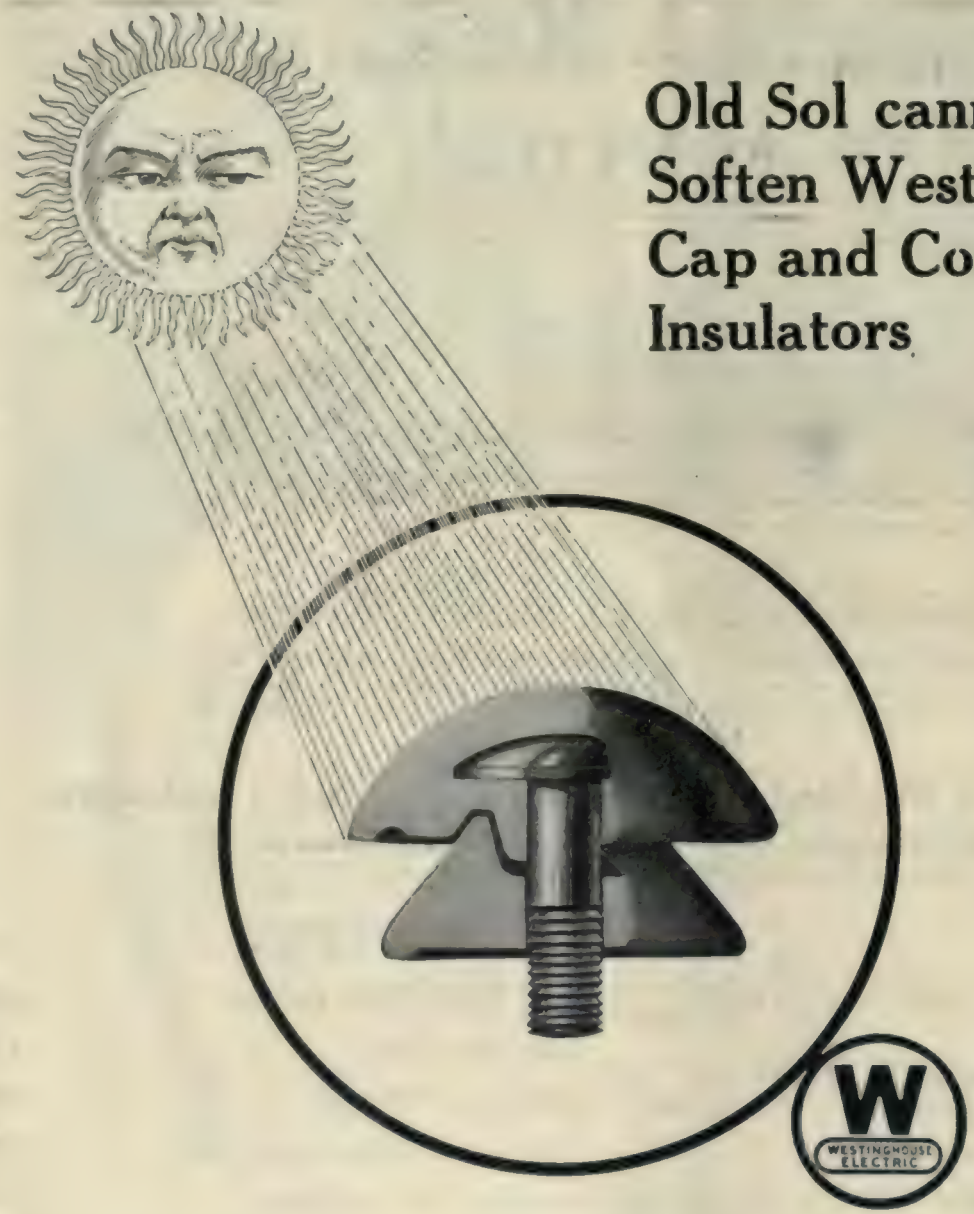
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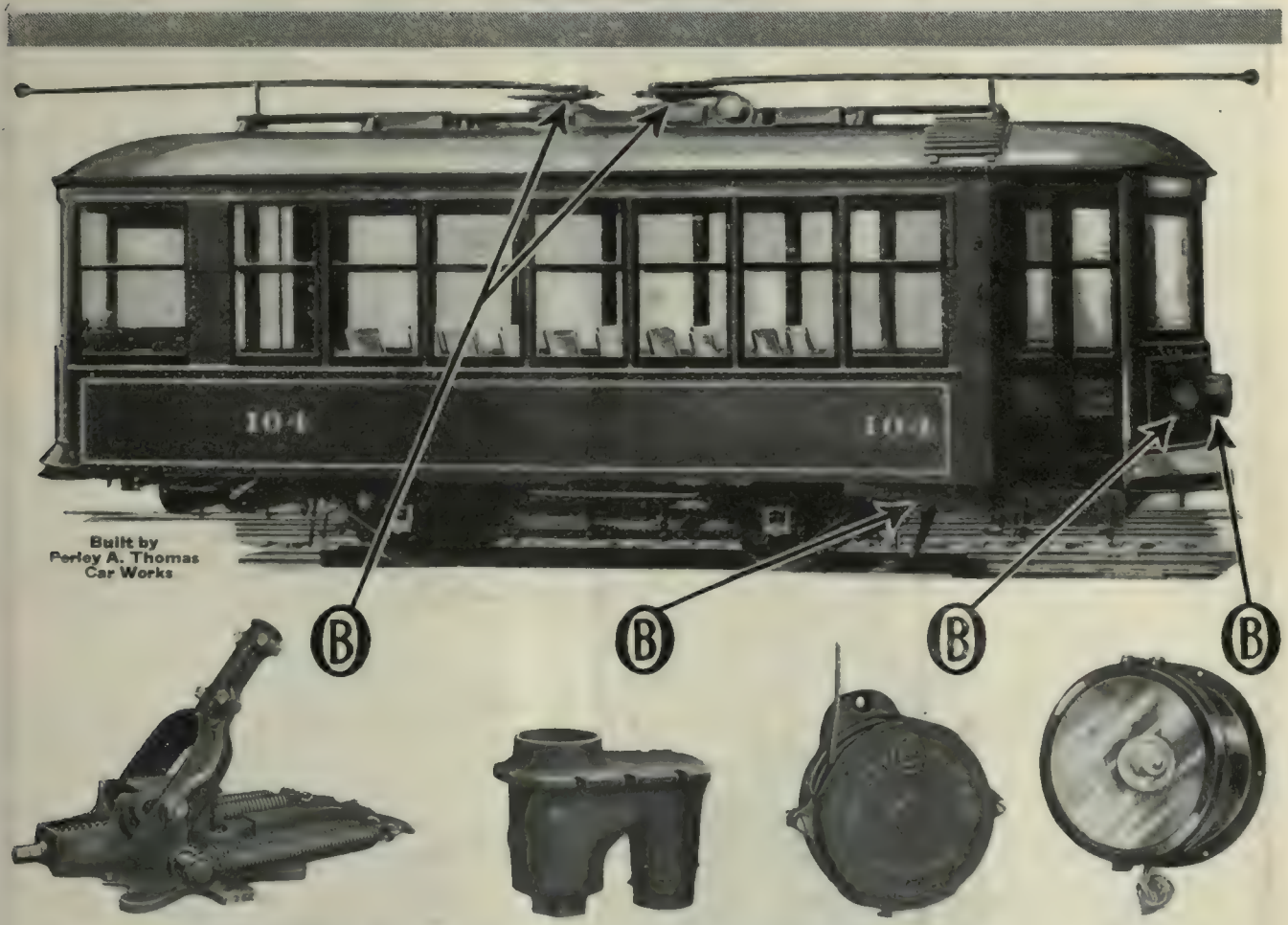
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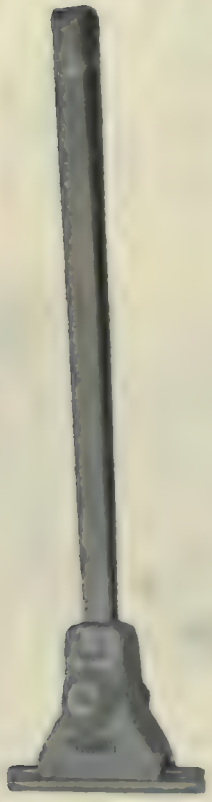
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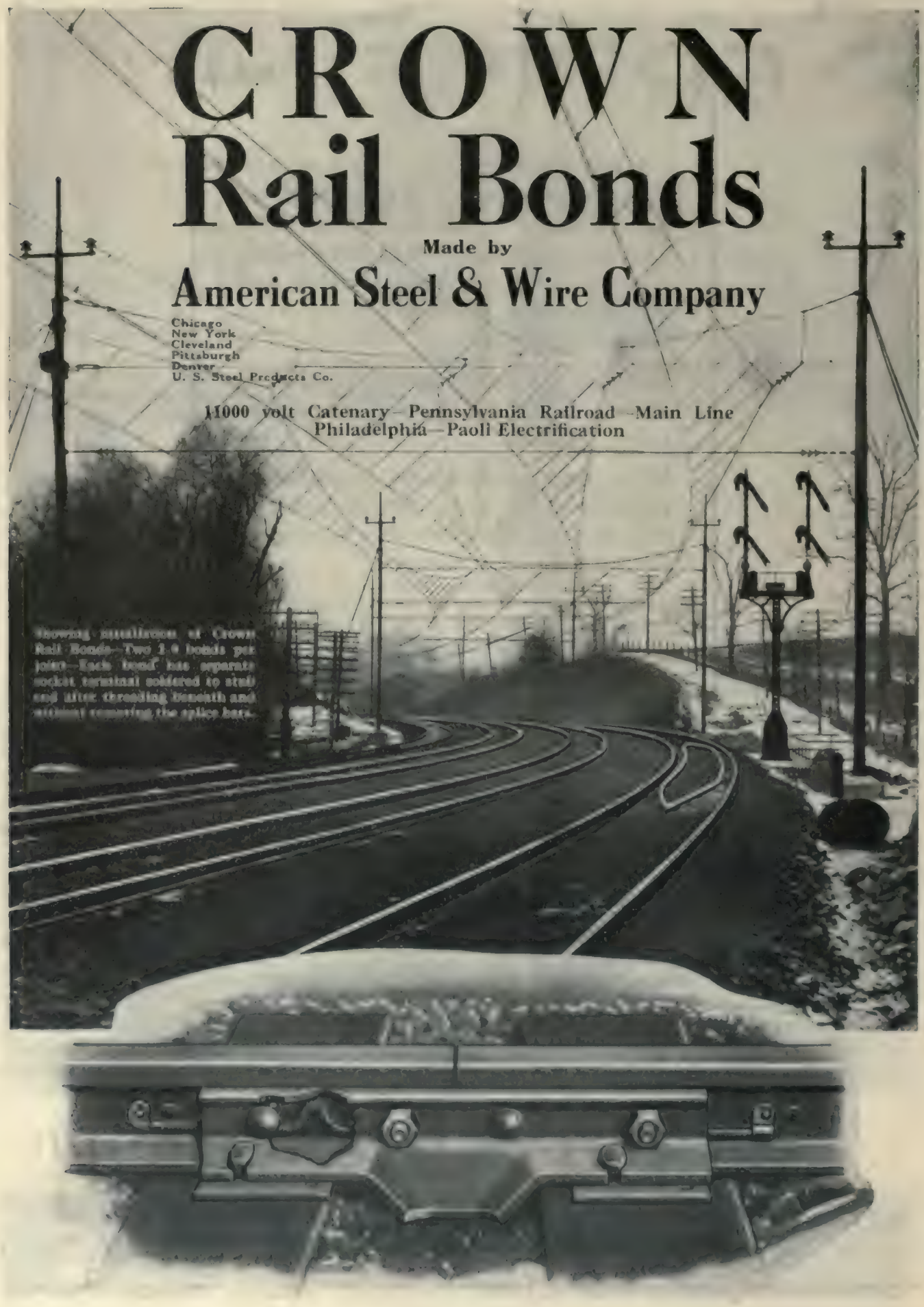
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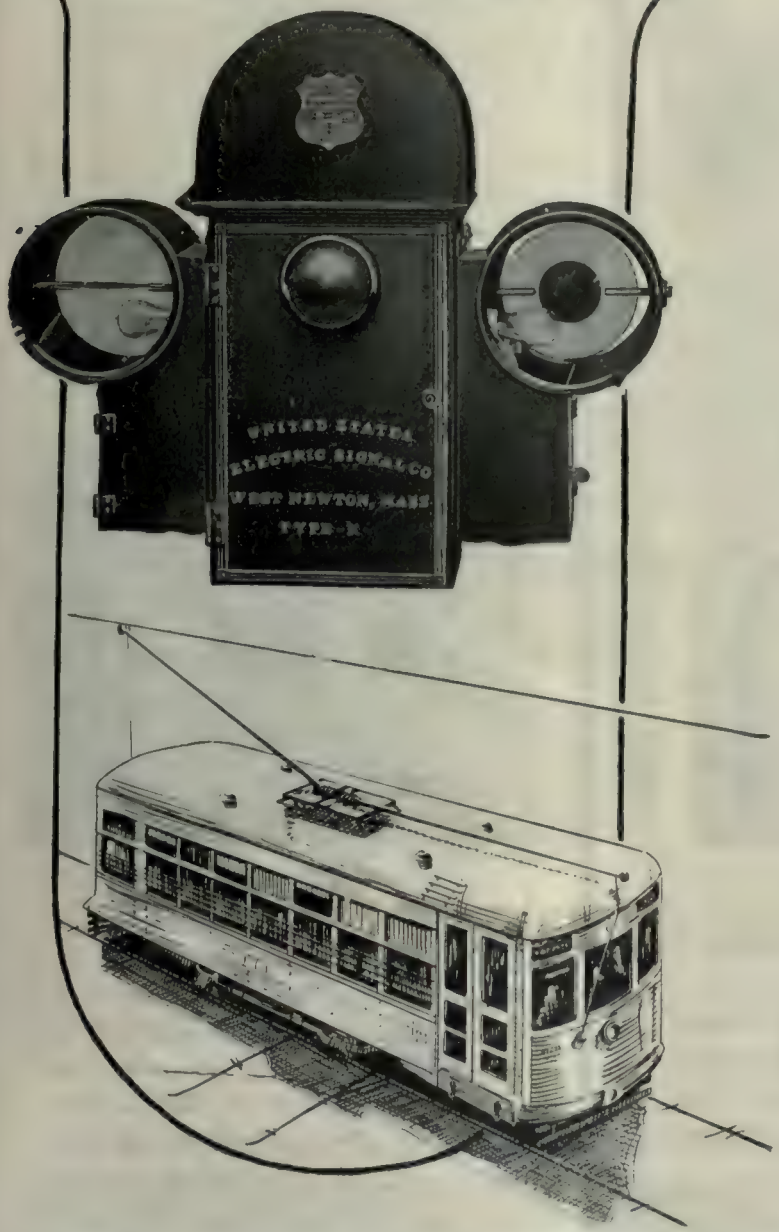
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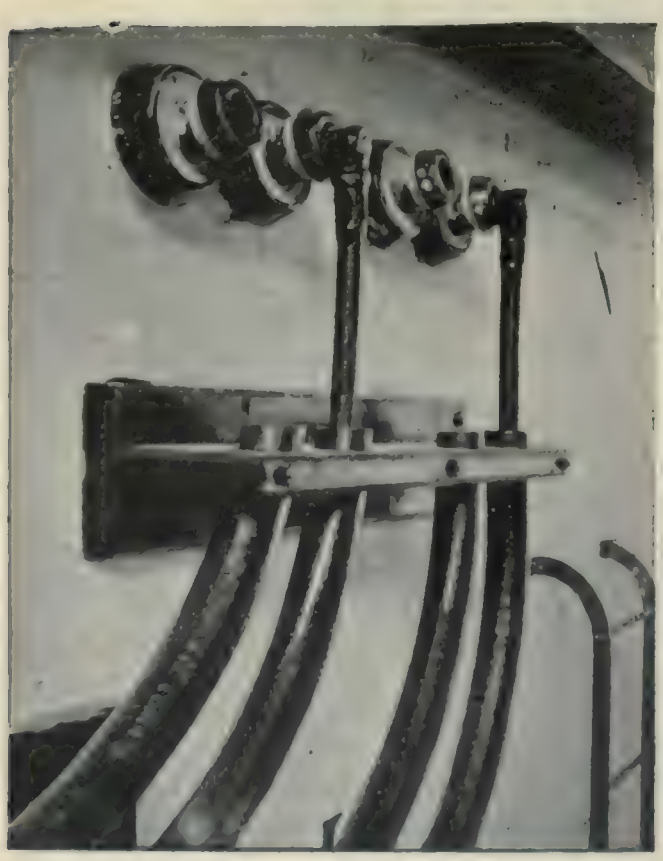
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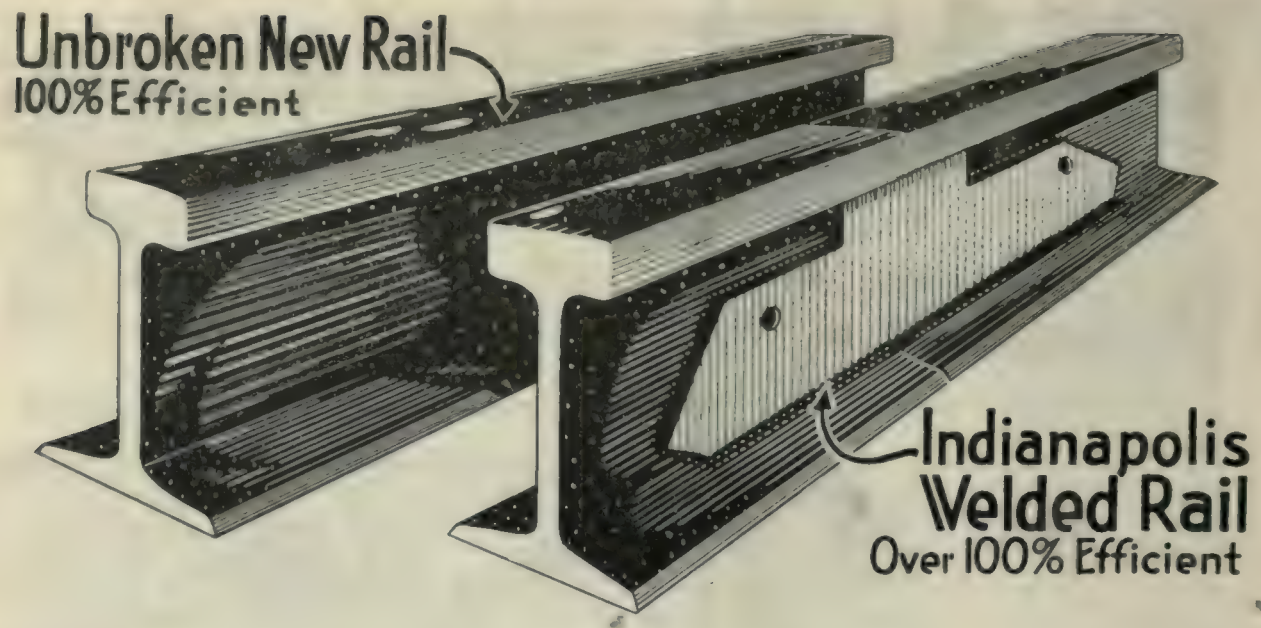
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Because every Indianapolis joint is perfect—because these joints eliminate cupped rail ends, loose pounding joints and bad bonds—the cause of 90% of track and rolling stock maintenance—over 100 railways in this and other countries are "Indianapolis Equipped." They use "Simplex" or "Apex" Joints and Indianapolis Electric Welders for applying the joints to the rail.

One loose, leaky joint can "eat up" the savings of ten good joints.

The way to get a *permanently perfect* track return is the Indianapolis way.

You can have quotations or immediate delivery. *Write.*



"Apex" Joint for Guard and Girder Rail

Indianapolis Switch & Frog Co.
Springfield, Ohio

The Value of Quality in Sheet Metal



Durability is a quality in sheet metal that seldom receives due consideration. Toncan Metal possesses this quality to a degree unsurpassed by any metal sheet made from Iron Ore.

Low grade sheet metal in car roofing, in ventilators and similar severe service, will usually answer the purpose very well, *while it lasts.*

But when it goes, it means not only the loss of sheet metal—it means also the loss of the expenditure for forming and installation.

That's why low grade sheet metal is the most expensive sheet metal you can buy.

That's why the quality assured by the Toncan Metal Trade Mark is the truest economy.



Thousands of installations—Roofing, Siding, Tanks, Culverts, Gutters, Pipes, Ventilators—in short, every conceivable place where sheet metal service is severe—stand as lasting evidence of the durability of Toncan Metal.

Toncan Metal will give *you* the same satisfactory service.

Write for our book of "Evidence"

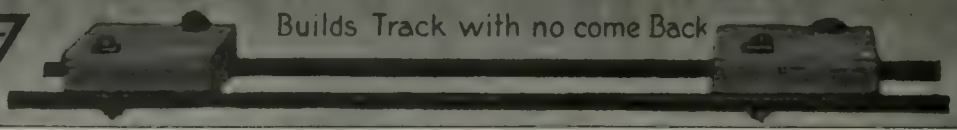
The Stark Rolling Mill Co.
Canton, Ohio

TONCAN METAL

Resists Corrosion

The RESILIENT RAILWAY TIE

Builds Track with no come Back



How is the life of the rail prolonged by the

Resiliency

of Dayton Mechanical Ties?

The cushion feature of Resilient Railway Ties allows just the right amount of rail deflection. Always the same; in the frozen ground of Winter or the soft thawing of Springtime. This lessens rail crystallization.

The joint tie supports the rail ends from the base of the rails and on exactly the same level. Broken down joints and battered rail ends impossible.

THE DAYTON MECHANICAL TIE CO., 704 COMMERCIAL BLDG., DAYTON, OHIO

Texas Electric Railway



Orders

Economy Meters

This large, high-speed, interurban system, operating at 600 and 1200 volts, will install a complete equipment of Economy Meters for its interurban lines which connect the cities of Dallas, Denison, Corsicana and Waco.

This contract was awarded after exhaustive competitive tests.

The decision by this organization to install Economy Meters is therefore a well earned indorsement of our motto,

Economy Power-Saving Railway Meters, by recording the kilowatt-hours consumed, show both the motorman and the management the individual "power bills." Thus they get down to the very fundamentals of energy checking and saving. In addition, individual car energy records afford data of high engineering value and a convenient basis on which to inspect car equipment.

"Meter the Energy—That's What You Want to Save"

Economy Electric Devices Company

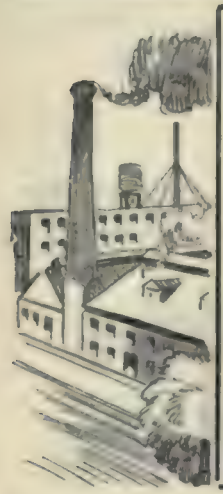
General Sales Agent **Sangamo Economy Railway Meter** **Old Colony Bldg., Chicago**

J. G. Monahan, Los Angeles
Ludwig Hommel & Co., Pittsburgh

National Railway Appliance Co., New York

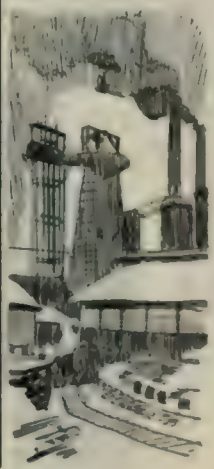
L. A. Nott, San Francisco
Burton R. Stare Co., Seattle

TRAVELS TO TOWNS WHERE THERMIT INSERT RAIL WELDING TERMINATED TRACK TROUBLES

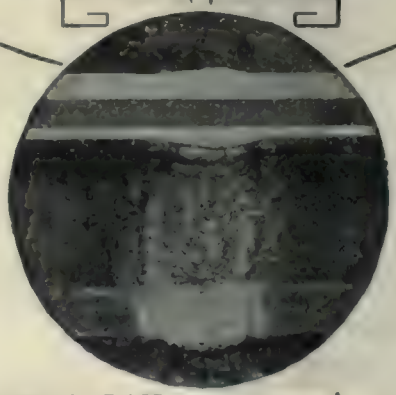




Pouring the Thermit steel into the mold, Youngstown, Ohio.



YOUNGS TOWN



It took the THERMIT INSERT RAIL WELD to put the "Young" in Youngstown track, for an inspection in September, 1919, showed that the 1100 or so Thermit joints welded by the Mahoning & Shenango Railway & Light Co. in 1916 and 1917 not only were still in perfect condition after over three years' service under a 5-minute headway of 35,000 to 70,000 lb. cars, but promised to add years of longer life to the joints and the rails. A careful examination of a large number of scattered welds showed that there was not only no cupping in evidence but no indication that cupping would ever occur. An accurate 2-ft. straight edge was used for this test.

Only 11 breaks out of the 1100 joints have been reported, 8 of these being at the top of a grade where the strain was exceptionally severe.

Send for Rail Welding Pamphlet 1232

METAL & THERMIT CORPORATION
120 Broadway
Chicago San Francisco
Pittsburgh Toronto



"Next Stop, Sharon!"

Meet the Public Demands



Increase Your Service without Increasing Your Rolling Stock

by Equipping Your Cars with

National Pneumatic Door and Step Control

The Public demands quicker service especially during rush hours. It probably has been impossible for you to speed up your service because your car stops have been too long. Your conductor has had his hands full collecting the fares and could not shut the door without losing lots of time.

By equipping your cars with National Pneumatic Door and Step Control you not only save the conductor's time but speed up each car. The stops get shorter. The running time is decreased which enables you to get more trips out of the same number of cars, thereby making the service frequent.

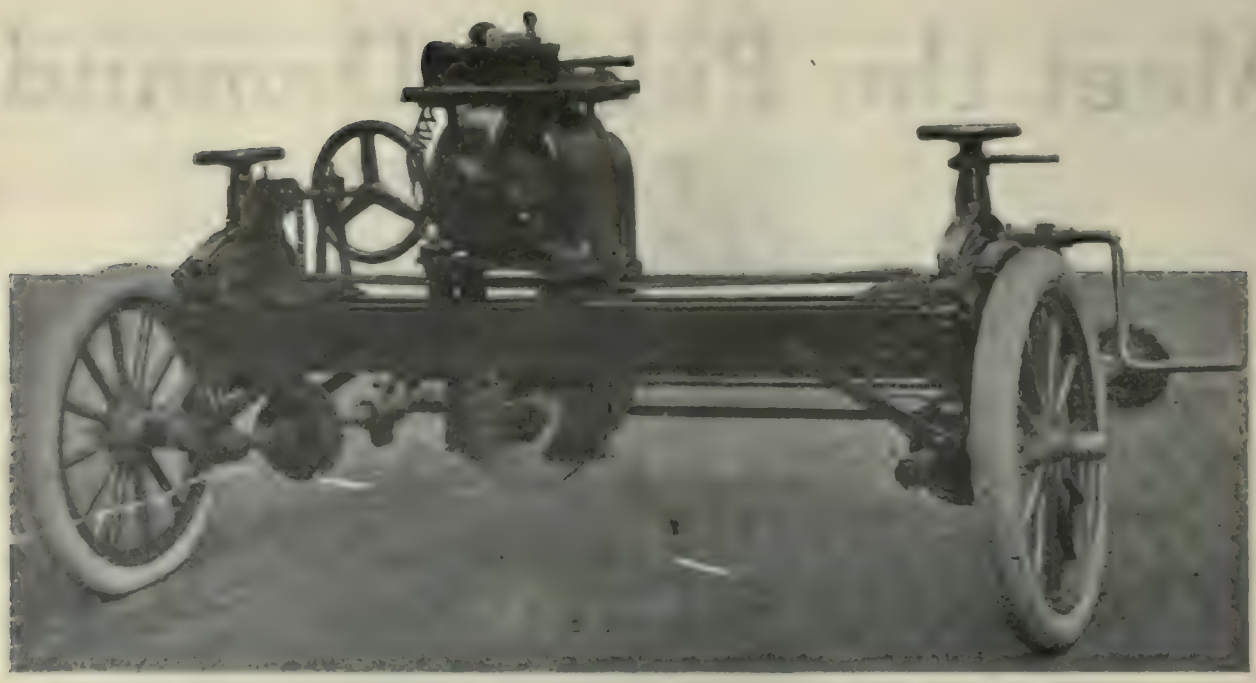
This makes a better satisfied public and increases your revenue.

National Pneumatic equipment pays for itself in a very short time out of the saving effected.

NATIONAL PNEUMATIC COMPANY INC.

50 Church St., New York **Edison Bldg., Chicago**

Works: Rahway, N. J.



The Universal Rotary Track Grinder

Built for Speed and Economy

The selection of track grinding apparatus should be governed by the character or class of work to be performed.

The "Universal Rotary Track Grinder" is especially adaptable for removing surplus metal produced in building up low or cupped joints by means of the arc welding process.

Features of this machine are: An outboard bearing on the grinding wheel spindle—adjustment of grinding wheel to grind at any angle—direct drive motor—large pneumatic tired derail wheels—ease of operation—accessibility and many other refinements which have been brought out after years of experience in the manufacture of track grinders.

Complete details sent on request.

RAILWAY TRACK-WORK CO.

3132-48 East Thompson St., Philadelphia

Agents—West and Middle West

ATLAS RAILWAY SUPPLY CO
Chicago, Ill

ELECTRICAL ENGINEERING & MANUFACTURING CO
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Exclusive Agents New England

CHAS. N. WOOD CO.
Boston, Mass.

HITCHCOCK LLOYD & CO. Inc.
77A Queen Victoria St. E. C.
London, England



"It Talks the Language of the Motorman."

Some Things Which Arthur Power-Saving Recorders *Do Not Do*

(1) They DO NOT register in terms of kilowatt-hours or other technical units which are not understood by the motormen. You cannot get the motorman's full co-operation if he is working in the dark as to what the figures actually mean.

(2) They DO NOT require complicated and expensive bookkeeping and follow-up methods such as are necessary when other devices are used. Nothing is gained if you have to spend as much or more for clerks as is saved in power.

(3) They DO NOT have any mechanical parts so delicate as to require floating in mercury baths to avoid shock and jar. Arthur Recorders are inherently rugged and will stand up in hard service.

(4) They DO NOT require frequent calibration as do other devices nor do they require a technical expert or college professor to tell whether they are right or not. A motorman can, himself, check their accuracy with his own watch.

(5) They DO NOT have visible spinning discs to catch the motorman's eye and attract his attention from the safe operation of his car.

(6) In a published statement the following was recently claimed as one of the advantages of a competitive "energy-metering" instrument for use on trolley cars:

> **"The motorman can note from watching his meter the relative amount of energy that is being taken when operating on series, on the resistance notches and at free running or balancing speed."**

We do not advocate motormen watching meters while operating cars. We believe such to be unsafe and improper operation. Arthur Recorders DO NOT put a premium on any practice contrary to safety first as do certain other devices.

(7) They DO NOT put a premium on excessively fast feeding. On the other hand they penalize the motorman who feeds too fast; likewise the motorman who feeds too slowly, thereby encouraging the motorman to operate his controller at a medium rate of speed.

(8) They DO NOT require several different sizes to take care of different classes of equipment. One standard recorder fits all types of cars.

(9) They DO NOT have to be wound up by hand as do certain other devices. They are automatically self-winding, and being at all times fully wound are more accurate than are other devices, and are therefore fairer to the motormen.

It has been proved that Arthur Recorders are the simplest, most practical and most effective power saving device ever developed for trolley cars. They are dust-proof and tamper-proof. Their effectiveness is indicated by the thousands which are in successful use.

For further information write to

The Arthur Power-Saving Recorder Company

Second National Bank Building, New Haven, Conn.

DURADUCT

Reg. U. S. Patent Office

"Do Not Substitute"

Put this on your order blank and when the material comes in, look for the black dotted line on the interior surface. Then you'll be sure you are getting THE ONLY NON-METALLIC CONDUIT WITH THE SINGLE INTERWOVEN WALL AND ROLLER-BEARING WIREWAY.

TUBULAR WOVEN FABRIC COMPANY
MANUFACTURERS · PAWTUCKET · R. I.
A. HALL BERRY · GENERAL SALES AGENT
71-73 Murray Street, New York 9 So. Clinton Street, Chicago
WENDELL & MacDUFFIE CO., 61 Broadway, New York City
Distributors for all foreign countries except Canada
Northern Electric Company, Distributors for Canada

ACKLEY BRAKES
Found The World Over

The
ACKLEY
No-Staff Brake

Smooth Drum System
No Sprockets—No Chain Cutting

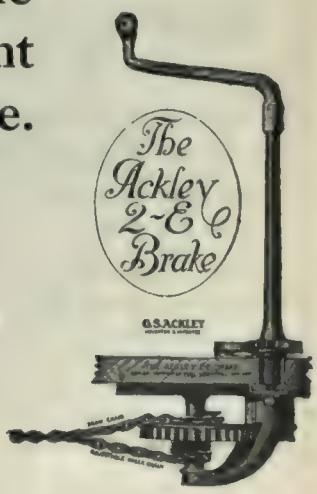
The double eccentric drum retards chain wear and provides a special regulator feature in permitting the unwinding of the draw chain only to the extent necessary for brake clearance.



Bulletin D

In ordering new or replacing old brakes specify

Ackley



Bulletin E

ACKLEY NO-STAFF BRAKE TRADE MARK

ACKLEY BRAKE & SUPPLY CORPORATION
G.S. ACKLEY & COMPANY, REPRESENTATIVES
50 Church Street, New York, U.S.A.
Agencies throughout the World
Cable address "Acklebrake"

ACKLEY 2-E BRAKE TRADE MARK



Checking Fares on 200 Properties with JOHNSON FARE BOXES

More than 200 of the most important railway systems in the country have found the solution of their fare collection and accounting problems in Johnson Fare Boxes.

These companies have found by experience and actual test that Johnson Fare Boxes make it possible to approach the aim of every railway man—to get a fare from every passenger and deliver these fares to the company.

The following list of properties partially tells the story of Johnson Fare Box efficiency.

These Roads use more than 1,000 JOHNSON FARE BOXES

Public Service Ry. Co.
United Railways Co. of St. Louis
United Ry. & Electric Co., Baltimore
Third Ave. Ry. Co.
Twin City Ry. & Lt. Co.

More than 500 JOHNSON FARE BOXES on these Roads

Connecticut Company
Eastern Massachusetts Street Ry. Co.
Capital Traction Co. and Washington Ry. & El. Co.
New York Rys. Co.
United Railroads, San Francisco
Seattle Municipal Street Railway

More than 100 JOHNSON FARE BOXES used here

Denver Tramways Co.
Omaha & Council Bluffs St. Ry. Co.
San Francisco-Oakland Terminal Rys.
International Railway Co.—Buffalo
Memphis Street Railway Co.
Northern Texas Traction Co.
Dallas Railway Co.
Municipal Ry. of San Francisco
Houston Electric Co.
San Antonio Public Service
Tacoma Railway & Power Co.
New York State Rys. (Rochester, Syracuse and Utica)
Tri-City Railway Co.
New Orleans Ry. & Lt. Co.
Michigan Ry. Co.
St. Joseph Ry., Lt., Heat & Power Co.
Brooklyn City R.R. Co.
Los Angeles Ry. Corp.

171 Other Railways

Besides the above listed properties there are 171 other electric railways using up to 100 Johnson Fare Boxes.

What Johnson Fare Boxes have accomplished for these roads they will accomplish for you. Write today for complete data.

JOHNSON FARE BOX COMPANY

Jackson Boulevard & Robey Street
Chicago

50 East 42nd Street
New York

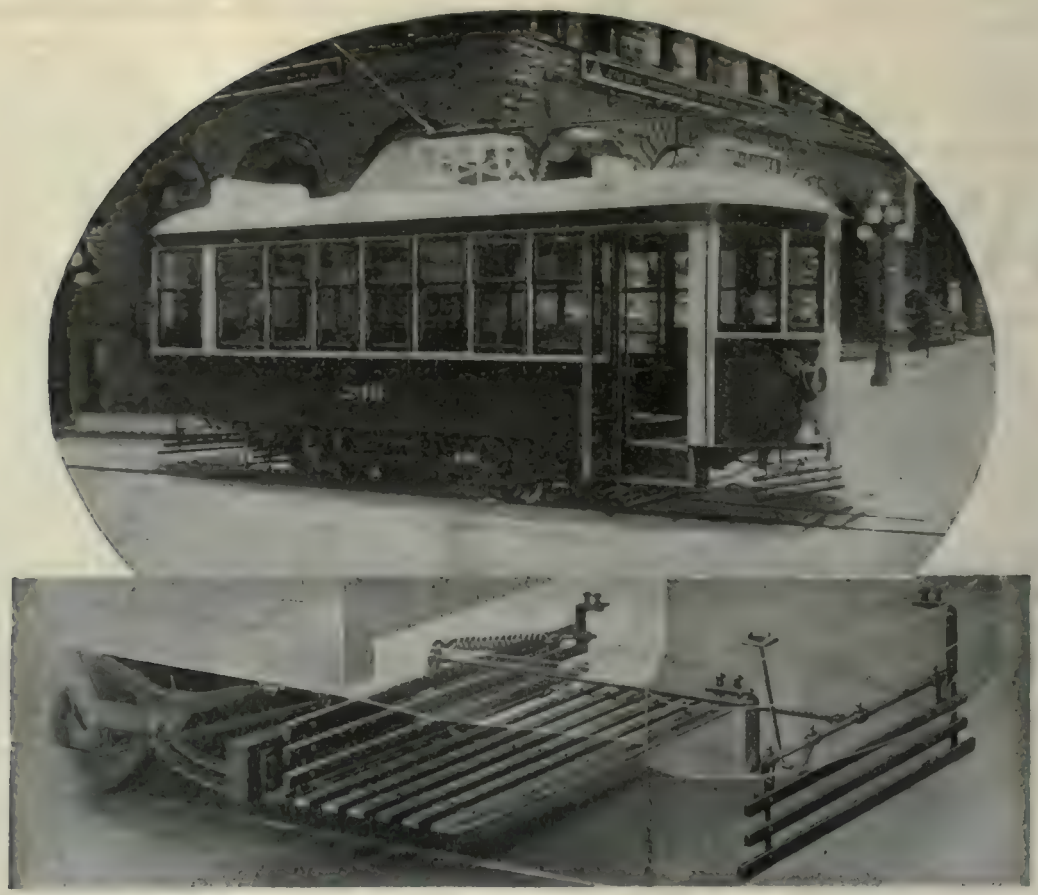
DAVIS STEEL WHEELS



Shop labor costs are lowered from the moment Davis Steel Wheels are applied until they are finally removed as scrap. This noticeable reduction in direct labor charges is supplemented by a marked reduction in power consumption and cost of supervision. It pays to specify Davis Steel Wheels from the standpoint of shop labor saving as well as operating economy.

American Steel Foundries

1100 McCormick Building, Chicago



Two That Belong Together—

SAFETY CARS
and
H-B LIFE GUARDS

Put them together and the result will be—money saved on accidents. Safety in car operation and a better satisfied riding public.

The H-B Life Guard is now the standard on most roads in this country and should be on yours.

Send for details

H-B
Life Guards

The Consolidated Car Fender Co.
Providence, R. I.

General Sales Agent

Wendel & MacDuffie Co.
61 Broadway, N. Y.

Providence Car Fenders



GRAY PERFECTION
Friction Tape
UTILITY
Friction Tape
HOLDTITE
Friction Tape
RELIO
Splicing Compound
USCO
Splicing Compound

Utility Friction Tape

Wherever a thin friction tape is desired, we recommend Utility. It is coated on both sides with a black compound that is adhesive and has the proper insulating qualities.

Utility is durable for outside or inside work, or for telephone work.

United States Rubber Company

The World's Largest and Most Experienced Manufacturer of Mechanical Rubber Goods

UNITED STATES RUBBER COMPANY
US
RUBBER SYSTEM
AND ASSOCIATED COMPANIES

Cut Down Your Maintenance Costs

By Using

ROCKBESTOS

Asbestos Covered Magnet Wire



Rockbestos insulation is as durable as the wire itself and its employment insures generators, magnets, motors, solenoids, transformers, and electro-magnet windings of every description against burning out from any cause, thereby reducing the possibility of breakdowns to a minimum and doing away entirely with any need of the expensive and time-consuming process of rewinding.

Rockbestos covered wire and cable has a field peculiarly its own. It must be used where considerations of safety from destructive and severe temperature rises in electrical apparatus will not permit the use of the conventional forms of conductors insulated with inflammable or slow-burning materials.



If you will so indicate, we shall be glad to submit samples of Rockbestos wire.

Marlin-Rockwell Corporation

Insulated Wire Division

New Haven, Conn., U. S. A.



Keeping Abreast With the Times

The above picture shows the first Electric Cars used in this country and the picture at the bottom of the page the new one man Safety Car which is the latest type of car used today.

Note the great progress that has been made in these comparatively few years in Street Cars.

Just so has this progress been made in Galena Oils and Galena Service. Our research and engineering Departments have worked hard to keep one or two steps ahead of the times and today—just the same as in 1869 when our business was founded—we stand in advance of the progress of the times.

Galena Service is now working at maximum efficiency in the work of producing betterments in operation through scientific methods of lubrication.

When Galena Service Goes In, Lubricating Troubles Go Out!



Galena-Signal Oil Company

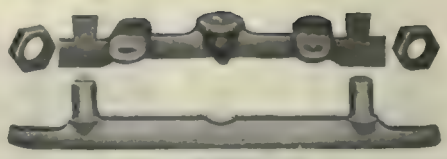
New York Franklin, Pa. Chicago

Works at Franklin, Pa., Parkersburg, W. Va., Whiting, Ind., St. Louis, Mo., Bayway, N. J., Toronto, Can., Rouen, France

Offices in all principal cities of U. S.
London Buenos Aires Paris



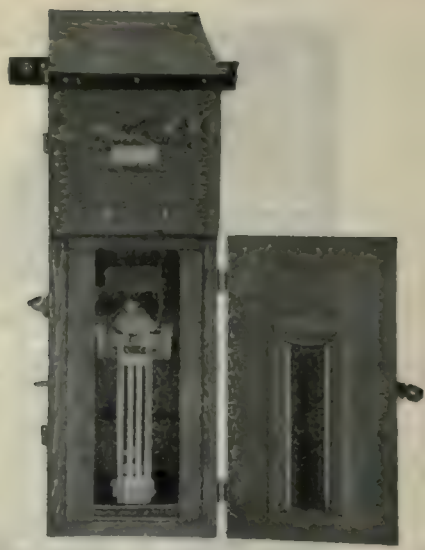
Form P-2 Hanger



Form S Strain Ear



Form N Trolley Frog



SW6 Sectionalizing Switch

Line Material of Proved Economy

The only parts of the Form S Strain Ear and the Form N Trolley Frog that are subject to wear are easily renewable. When these parts become worn it takes but two or three minutes to make a replacement. No tackle is required, as the body portions are not loosened from the trolley wire.

The Form P-2 Hanger has long been known as the "penny a year for maintenance" hanger. Rheostat insulators are interchangeable with this hanger for replacements.

The G-E Automatic Sectionalizing Switch normally ties all the sections together, equalizing the voltage all along the line and making additional power available to handle peak loads. Should a short circuit occur at any one point the switch automatically isolates the affected section until normal conditions have been restored.

The complete line of G-E devices for ordinary overhead construction is described in Bulletin 44004-A.

G-E Line Material

Can be delivered promptly from stock

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

40-118

Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Volume 55 New York, Saturday, April 17, 1920 *Number* 16

Association Standards Are Gaining a Foothold

THERE are good reasons for the belief that the American Association standards are gaining in use and popularity. As evidence of this, a recent visit by the writer to a large plant where special trackwork is manufactured disclosed the fact that the association standard girder guard rails are being specified for the major portion of the current orders passing through the plant. Incidentally, it was noted that the 7-in., 140-lb. section predominated.

Our talks with manufacturers representing other lines indicate that a similar situation exists with respect to the use of many other standards which bear the approval of the association. The long-standing tendency toward individual design seems, at last, to be giving way to the publicity which has been given to the standards. With this foothold gained in the strongholds of "personality" and "local conditions," the association should quicken its efforts to sell its standards to the industry, and the aid of the manufacturers should be asked to a greater degree. They should be reminded that their catalogs and advertisements should place emphasis upon every product which bears the approval of the association. There should be no let-up in the campaign of education which the committee on standards organized at last year's convention to advertise and popularize the several standards of the association.

"Count Ten. You're Blowing Up"

AS a maker of phrases Mr. Curran, president of the Borough of Manhattan, New York, is getting quite a reputation. In the early stages of the New York investigation Mr. Curran remained quiescent. As the investigation continued on its interminable way the thing began to get under Mr. Curran's skin. One day he arose and wrote himself down in local history by saying, "While the Mayor talks, the people walk." More recently in the traction inquiry he suggested to one of his fellows on the board that the alderman "Count ten. You're blowing up."

These are not weasel words. We know some people not in public life who could afford to count ten occasionally. One such is the manager of an electric railway who said in a newspaper interview that it was no further from the Mayor's office to the general manager's office than it was from the manager's office to the Mayor's. Of course, things which are the same distance apart are equally distant from each other. The Mayor to whom this quip was addressed probably didn't know the difference between Euclid and Mary Garden. Mayors don't have to be discriminating; managers do.

The manager's statement was foolish. It was not foolish because it was a fact, but because it was a fact it was foolish. That, perhaps, sounds Shavian, but it is not so Shavian as it sounds. The manager's act was courageous but foolhardy. The Mayor didn't count ten. He didn't have to.

Mr. Curran's advice is like that given by old Gorgon Graham. Summed up, old man Graham said that when you're in the right you can afford to keep your head and when you're in the wrong you can't afford to lose it. It would pay some electric railway men as well as others to paste this truism in their hats for reference. A man may be right in the convictions which he holds, but his attitude may be wrong. Count ten, gentle reader. You, too, may be blowing up.

Communities Are Acquiring the Sense of Responsibility

THE present strike of certain steam railroad employees may be worth all that it has cost and is costing the country if it establishes a proper sense of responsibility by the community for its own welfare.

The present day is eminently one of specialization in industry. This plan has many advantages, but it brings about a condition where a small group in any essential service can seriously inconvenience every one else by suddenly refusing to work. This is what is happening now, because while the firing of locomotives is only a very small part of our industrial life, reckoned in number of men employed compared with the total, yet it is a necessary cog in the machinery of industry.

How then can the community protect itself in this age of specialization from the unreasonable demands of a small but essential group of workers? It must obviously do something, because otherwise it would be completely at the mercy of any group anxious to increase its proportion of returns for services rendered.

One remedy is compulsory arbitration, but another, which was initiated during the Boston policemen's strike, continued in some parts of the Central West during the soft coal strike and is being extensively employed by the commuters about New York during the present firemen's strike, is the continuation of the work by volunteers.

All of us have specialized for so large a portion of our lives that we sometimes think it difficult or impossible to carry out any radically different task, even if only temporarily. But this difficulty has been found to be largely imaginary during this past week about New York, where prominent business men have been acting as volunteer firemen and crews on trains placed at their disposal by the steam railroad companies. Needless to say the affair has had a tremendous influence in developing a sense of community responsibility for its own welfare and there has been no scarcity of volunteers, either among the professional and business men or the students at the neighboring

technical schools and colleges. The attitude taken by these citizens is that transportation is a necessity which must be continued during the time that the strikers and the railroads take to settle the points at issue.

The average American citizen is pretty adaptable and the war has developed a knowledge of the power of community action. It has also shown the reserve strength at its command and that the organization of this strength is not a difficult task. If unions are wise they will see the meaning of all this.

Rolling-Stock Equipment Suffers From Severe Weather Conditions

THIS is the time of year when the mechanical man wishes the equipment of the cars under his charge could be mounted inside the cars or on the roof. Few persons outside of the operating and maintaining forces of an electric railway realize the great amount of work that is necessary in order to keep the equipment on the road during the winter season. To keep the tracks clear from snow is a large task added to the usual work of running the road, but probably the greatest difficulties from the equipment man's standpoint come when the snow commences to melt and spring rains cause high water all along the line. To keep the tracks clear of ice the water must actually be swept off before it freezes. Frequently cars are required to operate through water from a foot to two feet in depth. Of course, part of this water enters the motors, carrying with it large quantities of dirt and other refuse.

Water produces harmful effects on the motors in two ways. One of these is by weakening the insulation. The damp mud remaining inside the shell soon deteriorates the field windings and grounds and short circuits continue for a considerable time after the extreme conditions cease.

The second way in which harm results is from ice. Some of the water which enters the shell freezes. This ice reaches the armature and even the commutator. In addition constant effort is required to keep the bearings from becoming hot, as water gets into the bearings and waste and this freezes and entirely prevents lubrication. Hot armature bearings inevitably result in rubbing of armatures on the pole faces, with resulting serious damage to windings and wire bands. It sometimes happens that the tracks on which cars are laid up out of service become flooded and freeze overnight, so that the cars actually "freeze in" and cannot be moved. Not only does this water and ice cover the tracks and form ice around the wheels, but it also enters the motors, so that they are also firmly frozen in.

The department of electrical repairs of a railway is a very busy place at this season. Hundreds of armatures come in for repairs and field coils are sent in on account of grounds due to water conditions. Many are water soaked so that they require drying out before repairs can be made. The motors are not the only part of the equipment to suffer either. Grid resistors become overheated from slow and severe operation and then they are suddenly splashed with water or slush. This causes the grids to break and an open-circuited grid usually means a "dead car." During storms and sudden thaws of the present winter some roads have reported a majority of their cars as crippled at one time. No wonder the repair men are busy fellows.

Illumination Has Close Relation to Maintenance Costs

A CONTINUAL question is, "Am I doing all I can to reduce maintenance costs?" In this connection, a topic often overlooked is the relation of good illumination of repair shops and carhouses to the subject of maintenance cost. If it were shown that by doubling the lighting costs a railway company could save from three to twenty times the added expense in reduced maintenance charges there is no master mechanic but would be interested. Yet this condition may exist in any shop.

Good illumination for mechanical work does not mean merely enough light to see objects worked on and tools worked with. It means that illumination which will allow the most efficient use of time, equipment and material in doing a certain job. Many elements enter into good illumination, and in this connection illuminating engineers have been getting some new results, due to their researches. One of these is that ability to see satisfactorily for work is a function, not of amount of light alone, but of amount of light multiplied by time, at least up to a certain "saturation point." That is to say, by changing the illumination from 5 foot-candles to 10 foot-candles, for example, the operator can select the correct tool twice as quickly, he can locate various parts of the machinery more quickly, can move about the shop faster. In short, equipment can be put through the shop in less time and that means at less cost. And, too, better vision means less equipment going out poorly or not fully repaired, only to fail again in service.

Another effect of improved illumination is a physiological or psychological reaction upon the workers in the shop, causing them to be in better spirits, to want to move faster. It invigorates or instills "pep." The beneficial effects of improved illumination are cumulative. Of course, the lighting units must be installed with judgment as to intensity and distribution to get the best effects. An illuminating engineer can help, but much can be done by trying.

Take a look at your own shop. It may be that you can do something in this line to reduce its costs.

More "Bouquets" for the Givers of Good Electric Railway Service

AS THESE words are written, steam railroad transportation in several parts of the country is badly tied up. Fortunately the electric railways have been "on the job" and have demonstrated their ability to handle a vast emergency traffic and thus to perform an unusual public service. This is the second occasion within a few weeks on which the electric railways have justly earned the praise of their patrons, the earlier one being the occurrence of the heavy snowstorms which visited several sections during the past winter. The writer happens to live on one of the lines of the Public Service Railway of New Jersey and can speak from experience of the splendid way in which that utility has helped to fill in the transportation breach caused by the defection of railroad switchmen, brakemen and others in the vicinity of New York City. Although reasonably familiar with the local transportation system he has gained much new information as to the possibilities of getting about at very creditable speed, even with the suburban steam lines in a state of almost complete paralysis. And the same fact is illustrated by other

electric railways in the New York territory and in other parts of the country as well.

The bus has also played an important part in relieving congestion, often at prices which are several times the electric railway fares for the same lengths of ride. While the buses have done good service (at very profitable rates) they could have done much better for the public, and at lower cost, if they had formed a part of the rolling stock of the electric railway systems. A combined railway and bus system would prove to be a wonderful transportation machine, especially in times of stress, but also under normal conditions.

This paper has referred before to the essentiality of electric railway service. The point cannot be overemphasized. Under ordinary conditions the service is taken as a matter of course like air and water, except as a target for occasional shots of criticism. When trying times come round and transportation deprivation is the order of the day, then the inherent virtues of the service stand out prominently. And the people generally are becoming less reticent in expressing their encomiums. "Hurrah for the trolleys!" they say. "With all their faults we're glad they are still with us."

Tilting at Pavement Windmills Is Quixotic but Impractical!

CAN it be that our ever zealous civic officials are getting afraid that the goose which has so long laid the golden eggs of free pavements and perpetually free maintenance thereof is about to die an untimely death, strangled, as it were, by the generosity of the public officials in their refusal to grant a sufficient fare?

Can it be possible that they realize how proportionally large is the railroad "free" pavement area as compared with the total paved areas in their cities? We ask this question because in some cities the railways pave from 10 to 20 per cent of all the paved area in service, and were these cities to add such areas to those already maintained by them there would be a burden of cost which would surely make the taxpayers howl. For every mile of track in a paved street it is safe to say that the railroad pavement area now costs about $25,000, and in some large cities railroad pavements have been valued as high as $6,000,000.

These comments are elicited because of a statement which has recently come to our attention in which the argument is put forth by a city engineer that the common charge against the railway company for paving is just, and should even be increased, in spite of the fact that the car wheels do not touch the paving. As the thoughts expressed may be held elsewhere it is worth while to answer them in some detail.

To begin with, he says that car weights have vastly increased since horse car days and that these increases cause more vibration, which is detrimental to pavements. We grant the weight increases, but we can show him tracks and pavements over which 40-ton cars are operated without a tremor in the rails or pavement. He cites the fact that many roads are required by law to operate cars continuously, which prevents their cessation while pavements are under construction, as being detrimental to pavements. That all depends upon circumstances. Again, we can show him first-class track pavements over ten years old which were laid under constant car operation of say a 5-minute headway.

Our champion states that pavement surfaces should be impervious to water and that water cannot be prevented from getting down to the foundation in track pavements. Well, we can take him on a trip to many cities where the street railway engineers have succeeded in doing that very thing.

Our Sir Galahad then takes a tilt at costs. He says the presence of tracks requires a special and more expensive pavement construction. We can show him track pavements which are in far better condition than adjacent roadway pavements, and these track pavements not only did not require any more concrete than that in the roadways, but the track pavement actually cost less than the roadway pavement laid by the city. In connection with the special construction he claims as necessary, he says the rails require special types of brick at the gage side of the rails. Not so. Regular brick, properly laid, will serve as well or better.

Our expert, who hails from a rural city of 12,000 souls, calmly states that the presence of tracks requires an increased width of pavement in order to provide for the traffic on both sides of a car. He wants a 36-ft. curb width for a single track street. Well and good, but many real cities here in the East, where there are almost as many traffic cops as there are inhabitants in our up-state city, find that a great deal of business is done under dense traffic in streets of from 34 to 36 ft. curb width, and these streets have two car tracks.

He says a 24-ft. curb width is plenty for his borough, if car tracks be omitted. Very likely. But he misses the point when he says that his 36-ft. street, widened, as he says, for car tracks, costs the city any more for pavement. He forgets that the railway, with two tracks in the street, could be called on to pay for 18 ft. of pavement, leaving 18 ft. for the town, which is 6 ft. less than the 24-ft. width which he says is needed for a street without tracks and for which the town must pay all.

Next, on any street where there are tracks the burden of maintenance is partly, and in some cases almost wholly, borne by the railway companies. Railroad streets are usually main arteries and they attract traffic to them, which in turn takes greater toll in wear over the whole street. To that extent the city must suffer with the railroad and be glad that it does not have to maintain all of the pavement.

As a final argument in favor of the perpetuation of the uneconomic Section 178 of the New York railroad law, which requires the installation and maintenance of pavements by the street railroads, our gladsome knight solemnly affirms that the life of pavements on streets where tracks are located will be reduced 50 per cent. This is a broad statement to be based on such a large sphere of action as a town of 12,000. Again, we can show him pavements in tracks which will outlast the tracks and pavements laid fifteen years ago.

We have commented on this subject in a somewhat facetious vein the more to emphasize the principal fallacies in the views of so many engineers who are in charge of pavements in small cities. They do not get around enough to know what is going on elsewhere, and their opinions, formed from improper local conditions of track and pavement construction, are very apt to be wide of the mark. Yet our railway companies have to pay the price of such provincialism. It seems that there is a need for a campaign of education for the benefit of city engineers, with the object of proving to them that tracks and pavements can be made to work together successfully.

Safety Devices of the Safety Car*

Facts Regarding the Fundamental Characteristics of Safety Devices and the Principles of Operation of the Various Air-Operated Parts That Constitute the Equipment

BY JOSEPH C. McCUNE
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Foreword to the Series

THE extension of the use of safety cars and the constant broadening of the field for them suggest the importance of familiarity with the various parts that constitute an equipment. Safety devices are essential to insure easy, safe and efficient operation of the one-man type of car. The cost of maintenance and the number of irritating troubles and delays which occur when such cars are introduced are influenced to a large extent by the familiarity which the operator and maintainer have with the new equipment. Most railways are unfamiliar with the new types of apparatus developed for this service until they actually have them as an addition to their rolling stock.

The subject of safety car equipment is therefore timely, hence with a view of giving the present or prospective user as clear an idea as possible of the functions of the various parts and the care that should be exercised in their use and maintenance the *Electric Railway Journal* has arranged for a series of articles covering this subject. This, the first of the series, takes up the fundamental characteristics of safety devices. Others will deal with the care necessary in the equipment installation, troubles that may occur and their remedies and a systematic outline of the best maintenance practice, together with equipment tests.—*Eds.*

SAFETY devices which include the air brake and safety car control equipment have universally been accepted as necessary for the Birney safety car. But the necessity for safety devices does not arise from the structural features of such a car nor from any conditions of car construction, but rather from conditions of car operation. The fact that a car is double truck or single truck, light or heavy, single or double end does not in itself indicate whether safety devices are essential, but it is the method of car operation, whether the car is operated by one or by two persons, that determines this. Safety devices should be considered as a means whereby car operation by one person is made feasible and practicable. Probably such operation will be most successful both from an operating and a financial viewpoint with the standard Birney safety car.

Safety devices are demanded fundamentally because complete reliance cannot be placed upon human capabilities. If the mental man functioned correctly in every instance, automatic devices could be omitted; if the physical man had greater capacity, labor-saving devices would be superfluous; if mental and physical functions were properly co-related invariably, interlocking of operations could be dispensed with. But since some of these contingencies exist actually, the conditions of operation must be such that provision is made not only for outright man failure but also for the ordinary physical limitations. It is the function of the safety devices to furnish such provision.

To sum up, the safety devices provide for successful operation of the safety car because they insure that the operation shall be safe, proper and easy; safe, because man failure is provided for; proper, because the operator's movements are so interlocked that they must be taken in the proper sequence, and easy, because the operator's labors are reduced to the minimum by the use of air-operated devices.

The particular features that make operation safe, proper and easy are:

1.—The car cannot be started with the doors open because the brakes cannot then be released.

2.—The doors cannot be opened without causing a brake application sufficient to stop the car.

3.—Unintentional removal of the operator's hand from the controller handle will cause an emergency brake application.

4.—The brakes cannot "leak off" while the car is standing with the doors open.

5.—An automatic emergency application results if either of two pipes (emergency and safety control), running from platform to platform, is ruptured.

6.—The doors are changed from air-operated to hand-operated whenever an emergency application is made by the brake valve.

7.—The power is cut off, sand is applied and doors become hand-operated whenever an emergency application is caused by releasing the controller handle.

8.—If excessive cylinder leakage causes a service application to "leak off" while changing ends an emergency application will result.

9.—If the platform piping be ruptured by a collision an automatic emergency application will be obtained and the damaged piping will be so cut off as to prevent exhaustion of the main reservoir.

10.—After a stop the controller handle must be pressed down before the brakes are released.

11.—Ends cannot be changed without making a brake application before the operator leaves the operative end, or an automatic emergency application results.

12.—The sand is automatically applied in an emergency.

13.—The safety features are obtained without increase in the number of manipulative handles.

14.—The doors are air-operated.

15.—Sanding is accomplished by air without the use of a special handle.

16.—Provision is made for intentional and temporary release of the controller handle without emergency application resulting.

To determine how these various features are secured the principle of brake operation should be first understood.

It is believed that an explanation of the principle of

*The writer desires to express his appreciation of the courtesies tendered him by the Safety Car Devices Company and the Westinghouse Traction Brake Company.

operation will contribute to the reader's ease of understanding the detailed description to follow. All know that an air brake stops a car because compressed air admitted to a brake cylinder forces out the brake cylinder piston, which piston, through the medium of the levers making up the foundation brake rigging, presses the brakeshoes against the car wheels and so develops a retarding force which brings the car under control or to rest. If the brake equipment is such that air is admitted directly to the brake cylinder from the reservoir by means of a brake valve and no other means for such admission exist, then the equipment is said to be "straight-air" equipment. That is, the distinguishing characteristic of straight-air equipment is that the brake can only be applied by conscious manipulation by the operator. If, however, the brake is automatically applied under certain conditions, independent of the operator, then the equipment becomes an "automatic equipment." For an automatic brake the triple-valve principle is employed.



SAFETY CAR CROSSING DRAWBRIDGE IN TAMPA

A triple valve is a device in which a piston operates in a bushed cylinder. To the stem of the piston is attached a slide valve which travels back and forth over a flat slide-valve seat, covering and uncovering various ports in its movements. The slide-valve side of the piston is connected to a reservoir. The other side of the piston is connected to a pipe leading to a source of air supply. When air is admitted to this pipe the pressure built up on the pipe side of the triple valve piston forces the piston to move toward the reservoir until it encounters a stop. This position is known as "release," and in release position the reservoir and pipe are connected by a small feed groove in the piston bush. Consequently air flows by the feed groove and eventually pipe and reservoir are brought to the same pressure. Now if the pressure in the pipe be reduced very rapidly by allowing air to escape from it, since the pressure in the reservoir reduces less rapidly because of the slower rate at which reservoir air flows by the feed groove into the pipe, a pressure differential is built up upon the piston, which forces it and its attached slide valve away from the reservoir. This movement connects the slide-valve ports in a different way from that existing in release position and thereby causes the brakes to apply.

From this explanation it is evident that when the pressure in the pipe is reduced with sufficient rapidity the brakes will apply, whether or not this be brought about by the operator. That is, the brakes apply automatically whenever a rapid reduction of pressure in the pipe is obtained. If both service and emergency application are brought about by reductions in pipe pressure the equipment is said to be "automatic" brake equipment. If, however, only the emergency applications are so brought about the equipment is "semi-automatic." An emergency application is distinguished from a service application by the inability of the operator to limit the cylinder pressure attained.

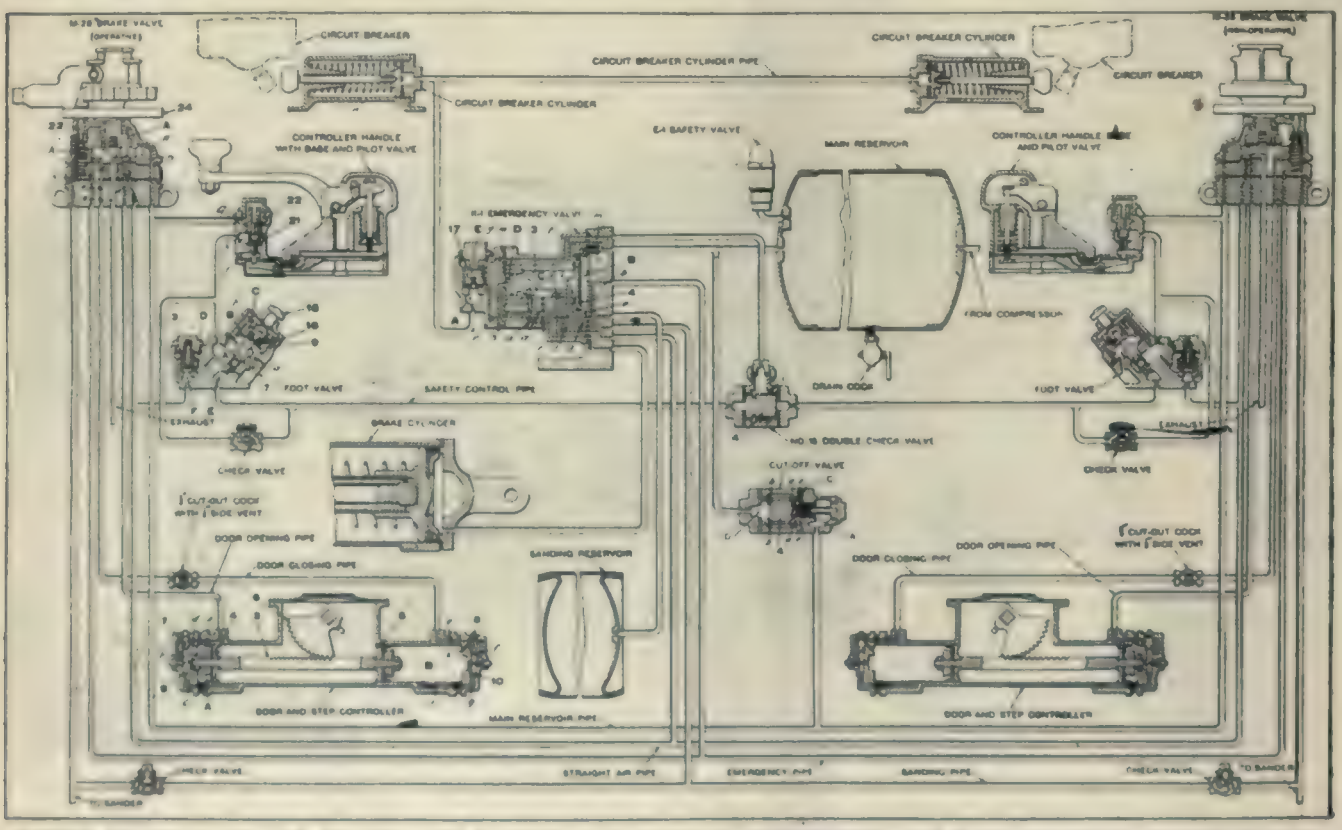
The equipment on the safety car is semi-automatic. Obviously it requires a valve of triple-valve type, this valve being designated the "emergency valve," and a pipe, called the "emergency pipe," normally charged to reservoir pressure, connected to it. It should be noted for use later in the description that when the pressure in the emergency pipe is rapidly reduced, regardless of how the reduction is brought about, an emergency brake application will be obtained. With the general principle that the reduction of pressure in a charged pipe may be utilized to cause movement of a piston, as explained above, in mind, the operation of the individual devices will now be explained.

Operating Principles of the Safety Devices

The safety devices, by which throughout the description is intended the air brake and safety car control equipment, comprise the following (see diagram):

(1) One motor-driven air compressor, (2) two main reservoirs, (3) one safety valve, (4) one compressor governor, (5) two brake valves, (6) one emergency valve, (7) two controller bases with pilot valves and controller handle, (8) two combined foot and cut-off valves, (9) one double check valve, (10) one main reservoir cut-off valve, (11) one sanding reservoir, (12) two circuit-breaker cylinders, (13) one brake cylinder, (14) two door and step controllers and (15) sundry cocks and check valves. In addition to these devices, there should be mentioned five pipes running the length of the car: (1) The main reservoir pipe, (2) the emergency pipe, (3) the safety control pipe, (4) the straight air pipe and (5) the sand pipe.

Of the above devices it is considered that, since they are so well known, the compressor, safety valve, governor and brake cylinder require no description. The other devices will be taken up in order. When reference is made to the diagram it should be remembered that this is simply an illustrative drawing and does not show the true construction of the parts.



PIPING DIAGRAM OF AIR BRAKE AND SAFETY CAR CONTROL EQUIPMENT—RELEASE POSITION, DOORS CLOSED

The brake valve has six positions: (1) Release, (2) lap, (3) service, (4) handle-off, (5) door-opening and (6) emergency. To the brake valve are connected seven pipes (the numbers referring to raised figures cast on the pipe bracket): (1) door-opening, (2) emergency, (3) door-closing, (4) straight-air, (5) sanding, (6) brake-valve-exhaust and (7) main reservoir. To realize how these pipes are connected in the various brake-valve positions it is first necessary to understand their functions. A constant supply of air at the brake valve is required. This is provided by the main reservoir pipe, which makes permanent connection between the main reservoir and the chamber above the rotary valve in each brake valve. Pressure is required to open and to close the doors, as explained later. Consequently air flows into the door-opening pipe when doors are to be opened and into the door-closing pipe when doors are to be closed. The function of the emergency pipe has been explained. The pipe is normally at reservoir pressure. Since the equipment is semi-automatic, air in a service application is admitted directly to the brake cylinder by the brake valve. The pipe by which this air is conducted is the straight-air pipe. The function of the sanding pipe and of the brake-valve exhaust pipe is self-evident.

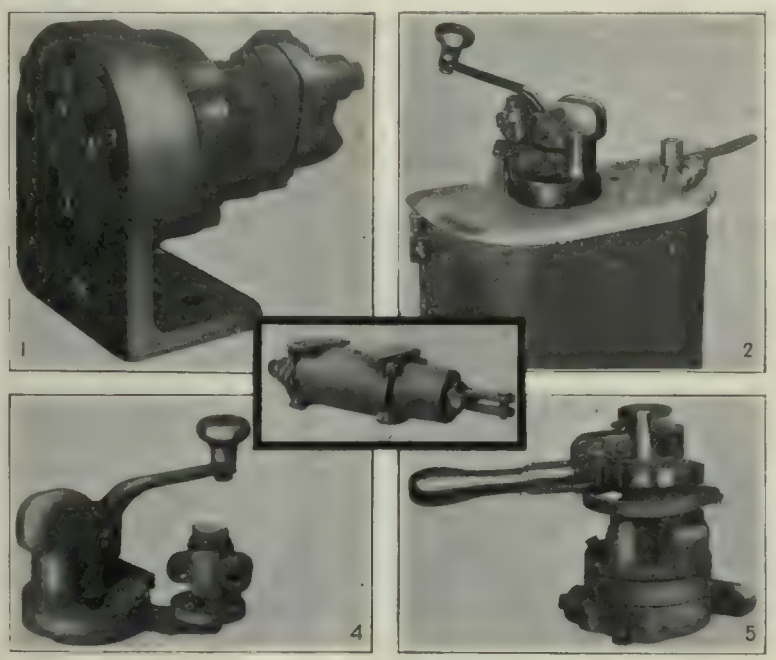
Three conditions should be noted in considering the brake valve. First, pressure to hold the doors closed is obtained from the emergency pipe rather than the main reservoir pipe, in order that the doors may be made hand-operated in an emergency, the manner in which this is accomplished being described later. Second, as a safety provision the doors are held closed by air pressure in all brake-valve positions except door-opening and emergency. Third, the emergency pipe must be cut off from chamber *A*, above the rotary valve, whenever air is flowing from this chamber. If the emergency pipe is not cut off, since the air in the pipe is at reservoir pressure, it will flow into chamber *A* and thence by whatever outlet the rotary valve has opened. This will bring about a reduction of emergency pipe pressure and possibly at a sufficiently rapid rate to cause an emergency application. To prevent such an occurrence the pipe must be cut off by the rotary valve. With these three conditions given it is apparent that: (1) In release the emergency pipe is open to the main reservoir, the door-closing pipe is connected to the emergency pipe and the door opening and straight-air pipes are connected to atmosphere (brake-valve exhaust pipe). (2) In lap the emergency and straight-air pipes are lapped, the door-opening and closing pipes remaining as in release. (3) In service the emergency pipe

is lapped, the straight-air pipe is opened to the main reservoir, the door-opening and closing pipes remaining as in release. (4) In handle-off, same as lap. (5) In door-opening the emergency pipe is lapped, the door-closing pipe connected to the atmosphere and the door-opening and straight-air pipes to the main reservoir. (6) In emergency, the emergency door-closing and door-opening pipes are all connected to the atmosphere and the straight-air pipe to the main reservoir.

It has been stated that the door cannot be opened without obtaining a brake application and that the cylinder pressure is maintained so long as the door is open. By referring to the above it will be noted that when the brake valve is in the position (door-opening) which will open the door by air the straight-air pipe is connected to the main reservoir, so that the compressor pumps directly into the brake cylinder.

In normal operation the piston 4 and the slide valve 3 of the emergency valve are in the position shown in the diagram. That is, the emergency piston does not move except in emergency operation. That this is so will be evident when it is considered that the pressure in chamber *B*, connected to the emergency pipe, is not reduced during a service application. Consequently, pressure differential sufficient to move the piston is not built up. The pressure on the piston is balanced, in so far as minor fluctuations in the emergency pipe are concerned, by means of passages *n* and *t*. The choke *n*, since it checks the flow of main reservoir air into the emergency pipe, permits the building up of a differential on the piston when the emergency pipe pressure is rapidly reduced. Chamber *D* is permanently connected to the atmosphere by passage *s*. Since chamber *C* is always at main reservoir pressure, a pressure differential, tending to hold the piston in release position, always acts on the small end of the emergency piston. This arrangement provides that slight differentials on the piston will not move it to emergency position, which is desirable in that it prevents undesired emergency application. In the ordinary service application air admitted to the straight-air pipe by movement of the brake valve to service position flows to the brake cylinder by the straight-air pipe and passage *d*, cavity *f* and passage *a* in the emergency valve. That is, as noted, the emergency valve does not operate in service operation, air to and from the brake cylinder merely passing under the slide valve.

In an emergency application, however, the pressure in the emergency pipe is very rapidly reduced. This means that the pressure in chamber *C* becomes considerably greater than that in chamber *B*, which obviously results in the piston with its attached slide valve moving toward the right. Main reservoir air then flows directly through the emergency valve into the brake cylinder by means of passage *t*, chamber *C* and passage *a*, and thereby applies the brake. Evidently the brake-cylinder pressure will be immediately built up almost to that of the main reservoir, and since connection between reservoir and cylinder is not cut off the capacity of the compressor is available toward preventing the brakes "leaking off." At the same time the sanding reservoir (which is normally maintained at reservoir pressure by means of passage *t*, chamber *C* and passage *g*) is connected to the sanding pipe by cavity *p* and passage *h*, which causes air to flow to all sand traps. Moreover, since pressure for holding the doors closed is obtained from the emergency pipe and since the air in the emergency pipe has been vented to the atmosphere the pressure on the doors is removed, which allows them to be opened by hand. Relay valve *E* is the valve by which an emergency application is brought about upon releasing the controller handle. As will be explained later, chamber *E*, connected to the safety-control pipe, is normally maintained at reservoir pressure. The annular space on the lower side of the valve is likewise maintained at reservoir pressure because it is connected to the emergency pipe through passage *e*. Chamber *A* is normally at atmospheric pressure because it is connected to the circuit-breaker cylinders, in which pressure cannot long be maintained because of the drilled opening in the circuit-breaker cylinder piston. If, therefore, the pressure in the safety-control pipe and chamber *E* is suddenly reduced the higher pressure acting upon the annular space on the lower side will force the relay valve upward. The emergency pipe is then connected to the circuit-breaker cylinders by passage *e*. A sudden drop in emergency pipe pressure results, with a consequent emergency brake application. In addition, the air vented to the circuit-breaker cylinder builds up a pressure therein which moves the pistons outwardly, causing them to strike the circuit-breaker handle and open the circuit breaker. Of course the power is then cut off. It will be noted then that a sudden drop in safety-control pipe pressure opens the relay valve, which causes an emergency application of the brakes, the sanding of all wheels, the cutting off of power and the release of air pressure on the doors. That the relay valve may not be opened by slight differences in safety control and emergency pipe pressures passage *y* through the relay



SAFETY CAR CONTROL EQUIPMENT

No. 1—Emergency valve. No. 2—Safety control group. No. 3—Brake cylinder. No. 4—Controller handle with base and pilot valve. No. 5—Motorman's brake valve.

valve is provided, which permits the equalization of such differences.

The reader should observe that to cut off power it is necessary that the relay valve open. It may be caused to open by "letting go" the controller handle. On the other hand, if the emergency application be brought about by the brake valve (reduction in emergency, but not in safety-control pipe pressure) the relay valve does not open. The first operation assumes an automatic emergency application because of man-failure, the second a conscious emergency application by the operator. In the former case the power must be cut off automatically; in the latter, it is done by the operator. Consequently, since no need exists, power is not automatically cut off when an emergency application is obtained with the brake valve.

Safety Control Group and Combined Foot and Cut-Off Valve

The pilot valve of the controller base is the actuating agency of the "dead-man feature," whereby an emergency brake application results whenever the hand is removed from the controller handle. The controller handle is pivoted in a casting which rotates with the handle's movement. It will be evident from the diagram that so long as the handle is held down the bolt, upheld by the handle, will compress the spring. If the handle be released the compressed spring will cause the bolt to move downward and strike the lever in the bottom of the controller base, which in turn will unseat valve 21 and seat valve 22. Now when the controller handle is held down (the spring being compressed) valve 22 is unseated, which permits main reservoir air to flow into the safety-control pipe by passages *a* and *h*. As explained in the description of the emergency valve, when the safety-control pipe is at main reservoir pressure the relay valve *E* is seated. If the controller handle be released valve 22 is seated and valve 21 unseated. The seating of valve 22 cuts off main reservoir pressure, while the unseating of valve 21 connects the safety-control pipe to atmosphere by passage *f*. The sudden reduction in safety-control pipe pressure resulting causes the relay valve to open and brings about an emergency application with a cutting off of power, a sanding of the rails and a release of door pressure, as explained above.

Any unintentional release of the controller handle will cut off the supply of main reservoir air to the safety-control pipe and at the same time connect the pipe to atmosphere. The resultant drop in safety-control pipe pressure will of course cause an emergency application. That the operator may at times desire to release the controller handle is obvious, in which case an emergency application is not desired. The emergency application is prevented in such an event by the combined foot and cut-off valve. Before the hand is released from the controller handle knob 15 (see diagram) is pressed in by the operator's foot. This causes valve 7 to seat and cut off the safety-control pipe from the pilot valve. Therefore, when valve 21 opens upon the release of the controller handle escape of safety-control pipe air does not result. It is consequently obvious that the operator's foot may relieve his hand whenever desired.

In the above description the case considered was where the operator held his foot on the knob while the car was in motion until such time as he again desired to press down the controller handle. At a stop where the operator is occupied in collecting fares it would be inconvenient for him to be compelled to hold down knob 15 continuously. Such a necessity is obviated by cut-off valve 3. When a brake application has been made brake-cylinder air enters chamber *F* and when a pressure of approximately 30 lb. has been attained valve 3 is forced upward, permitting brake-cylinder air to flow to the top of valve 16 and force it downward. This downward movement seats valve 7 and thus cuts off the safety-control pipe precisely as though knob 15 had been pressed in by the operator's foot. When the cylinder pressure has been reduced during the release to about 12 lb. the compressed spring above valve 3 will cause it to close. Chamber *C* is then immediately exhausted to atmosphere by way of passage *b* and the vent port above valve 3. Safety-control pipe pressure acting on valve 7 causes it to move to its upper seat and again connect the safety-control pipe to the pilot valve.

In addition to the function described above, cut-off valve 3 enables the operator to change ends without an "emergency" resulting when the controller handle is removed. Before leaving the operative end the operator makes a service brake application. This application results in valve 7 closing, as previously explained, so that an "emergency" does not occur when the controller handle is released. If the brakes "leak off" before the operator assumes control at what has been the non-operative end valve 3 closes, which causes valve 7 to open. Since the controller handle is not held down safety-control pipe pressure is exhausted to atmosphere by valve 21, thereby causing an emergency brake application.

The function of the double check valve is to cut off the non-operative end of the safety-control pipe, since the pilot valve on this end is open to atmosphere. The check valve is moved from one seat to the other, depending upon which section is charged and which connected to atmosphere.

The purpose of the main reservoir cut-off valve is to conserve main reservoir pressure in the event of a ruptured main reservoir pipe beyond the cut-off valve itself, as, for instance, a ruptured platform pipe. Without this valve a main reservoir pipe rupture would involve a very serious drain on main reservoir pressure. In service, air flows by passages *b* and *a* (see diagram) at such a rate that sufficient differential is not built up on valve 4 to compress the spring. In the event of a broken pipe, however, pressure in chamber *A* is so rapidly reduced compared with that in chamber *D* that a differential is built up sufficient to move valve 4 to the right and thereby cut off further outflow. The broken pipe is in this way disconnected from the main reservoir.

Door and Step Controller

The sanding reservoirs and circuit-breaker cylinders require no special description. The door and step controller (see diagram) is of the double-acting piston type with the pistons connected by a rack. The rack operates a segmental gear attached to a shaft, which shaft in turn actuates the rods and levers which open and close the doors and steps. With this type of controller the door is held closed by air pressure. When it is to be opened the door-closing pipe is connected to atmosphere and the door-opening pipe to the main reservoir. When it is to be closed the process is reversed, except that the emergency pipe is substituted for the main reservoir. Slamming is prevented by a cushioning effect, produced by a special porting arrangement. Air is admitted to

the double-acting controller cylinder by large ports such as passages *f* and *k*; exhausted by smaller ports, *h* and *g*, reduced to *g* only after the piston has traveled about half of its stroke. Passage *g* may be regulated by the choke plug to make the door closing that desired.

A special ⅜-in. cut-out cock with side vent, in connection with which the brake-valve handle is used, is located in the door-closing pipe so that the motorman may, independently of his brake valve, take the air pressure off the door, thus making it hand-operated. This arrangement provides for those cases where the motorman may be forced to leave his car to turn a switch, etc.

The foregoing description applies to the latest design of safety devices. Many cars are in operation equipped with safety devices which do not include all those shown in the diagram, or perhaps may include some of the devices in different form. From the operation as explained, however, it is hoped that no difficulty will be encountered in understanding the functioning of these slightly different devices, since it has been the aim of the writer to explain the principles of operation rather than the particular detailed functioning of a specific device. He trusts that this exposition of principles has been of interest to the reader.

Maintaining Electric Railway Motors—I

Rewinding Armatures, Smoothing and Slotting Commutators and Correct Brush Methods Are Discussed in Detail

By JOHN S. DEAN
Industrial & Railway Motor Engineering Department, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

IF SYSTEMATIC inspection and maintenance of car motors was ever necessary for the successful operation of an electric railway, it certainly is a paramount issue now. In fact, every piece of apparatus must be fully utilized if the railway is to give adequate service at the lowest possible cost.

The very nature of the service to which electric cars are subjected entails considerable wear and tear on the various parts of the car and constant and systematic care and attention are required to keep it in good operating condition. This is especially true of the motor, due to its position under the car, where it is exposed to outdoor weather conditions, and also on account of its rigid mounting on the car axle it is subjected to very severe mechanical shocks and vibration. Some of the precautions taken and methods used to keep the apparatus in good condition are outlined below.



TESTING STRENGTH OF BRUSH SPRINGS BY MEANS OF AN INDICATING SPRING BALANCE

Care Necessary In Winding Armatures

To insure the best life from an armature extreme care should be used when rewinding to see that every point that might cause failure is guarded against in a satisfactory manner. First of all, any sharp corners and any roughness in the slots that might damage the coils should be filed down and all chips and filings removed from the slots before the insulating material is applied to the core. The coils should fit tightly in the slot and be wound so that the tops of the coils are ⅛ in. above the band groove. Fillers should be used between the coils if necessary to meet the above conditions. The core bands will then pull the coils down to a tight fit on the iron, which reduces the movement of the coils in the slot to a minimum. If the coils are wound too high the bands will not rest on the iron, and when the insulation dries out in service looseness of the bands will result. Care should be used not to twist, bend or abuse the coils any more than necessary during the process of winding. The necessary crossing of coil leads, if not properly arranged, will cause short circuits when the pressure of the band is applied. The coils on the end windings should have a solid foundation for the bands, but pounding should not be carried to the extent that the coils or leads become damaged. Protecting pieces of insulating material should be inserted at all points where the coils cross and where there is danger of short circuits occurring. It is good practice to weave braid between the leads directly back of the commutator, on both top and bottom layers.

All leads should be tinned in such a manner that there will be no untinned copper in the commutator neck. The cotton sleeves on coil leads should not be permitted to extend into the commutator slot, as they may obstruct the flow of solder, which will result in poor commutation. The tool used in driving the leads into place should be free from sharp corners and edges, for a nicked wire might be the cause of a broken lead.

The following winding facts and rules will be of assistance:

The wave or two-circuit winding always requires an odd number of commutator bars.

When an even number of coils per slot is used there will always be an idle or dead lead.

When an odd number of coils per slot is used and there is an even number of slots in the armature there will always be an idle or dead lead.

When an odd number of coils per slot is used and there is an odd number of slots in the armature there will never be an idle or a dead lead.

CARE OF COMMUTATORS

The band over the front V-ring of a commutator should be wiped off clean every month. After cleaning, painting with an air-drying varnish makes cleaning easier the next time. Painting every six months is advisable.

Flat spots, high or low bars, ridges, burned spots, etc., should be smoothed up. Where these are not bad the motor need not be removed from the car. A tool can be made by mounting a block of wood on a stick, one face of the block being cut to the radius of the commutator and lined with sandpaper or stone. As the car is run by the other motors this tool, held against the commutator, will smooth the rough spots.

The armature should be removed from the car and placed in a lathe for the turning of the commutator if its face is very rough. After turning, the grinding of the surface with a fine abrasive stone gives a very smooth and true surface and improves commutation. Holes left by defective mica or pits in the side of bars can be filled with commutator cement.

In removing leads from the commuator neck a thin "drift," driven toward the armature shaft between the side of the commutator neck and the filling piece or wedge, will loosen the filling piece so that it can be easily forced out with a gouge. A similar operation on the leads will remove them from the first bar. Then with one commutator neck free of leads clearance space is available for the bending of each commutator neck consecutively, permitting the removal of all the remaining coil leads by means of the gouge. By this method no heating of the soldered joints is required.

The commutator slots should be kept well undercut, ⅛ in. maximum; 1/16 in. minimum; the front V-ring clean and well painted; the edges of commutator face rounded, 1/16 in. radius front, 1/16 in. radius rear; the commutator free from oil, grounds or short circuits; the rear of commutator sealed from dirt and moisture; the commutator tight; the face of commutator smooth; the neck full width, and the mica extending 1/16 in. at rear.

The commutator should be re-undercut before it is worn flush, since the groove left will guide the saw and make the work much easier. After slotting is completed the face of the commutator should be thoroughly polished and cleaned of all particles of copper by means of sandpaper.

It is essential that all particles of mica be removed from between the segments by this operation, so that it is advisable to use a saw about 0.005 in. thicker than the thickness of the mica to be undercut. A small-diameter saw must be used in order to cut the slot to the proper depth and at the same time not cut into the neck of the commutator. After the slots are sawed it is sometimes necessary to go over them with a small hand-cutter, or scraper, to remove all remaining particles of mica.

Where commutation trouble is frequent it is good practice to use a V-shaped hand tool to round the edges of the under-cut grooves between bars to about 1/16 in. radius. This can be done without removing the motors from the car.

Clean undercutting of commutators eliminates high mica, thus reducing burning of the commutator bars and giving extended life to carbon brushes. By this means practically all flashing is prevented and maintenance costs are greatly decreased.

MAKING BRUSHHOLDER REPAIR

To care for the brushholders of the railway motors intelligently it is necessary for the maintainer to be familiar with the construction and purposes of their parts. In repairing and replacing a modern railway



CONDITION OF RAILWAY MOTOR CARBON BRUSHES AFTER BEING USED IN VARIOUS TYPES OF SERVICE

motor brushholder of the insulated-pin type the following points should be considered:

The brushholder castings and mechanism should have at least ¾ in. air clearance from the motor frame.

The porcelain insulators give sufficient creepage distance over smooth corrugated surfaces to keep the brushholders from becoming grounded to the frame and should always be kept tight on the pin by putting pieces of treated linen between the porcelain and tube. They should be kept free from carbon dust and dirt to prevent current from leaking over the surface. It is a question if porcelain insulators are necessary, and in some cases they have been left off with satisfactory results in service.

Railway motor frames, as built today, have machined pads for supporting the clamping blocks of the brushholders exactly in the neutral position. On replacing brushholders the clamping blocks must be seated properly. The carbon box should be parallel with the commutator bars and the distance from the center line of one box to the center line of the other box on a four-pole machine should be equal to one-fourth the number of commutator bars. The coil short-circuited by the brush should be midway between the main poles. Ordinarily

this means that the brush will be opposite the middle of the main poles. Brush spacing is adjusted by the manufacturer and will be correct if the clamping blocks are always seated properly. Care should be exercised to see that the brushholders are those belonging to the motor and that they are not damaged.

The underside of the carbon box should be kept within ⅛ in. to 1/16 in. of the commutator surface, so as to prevent breakage of carbons. This adjustment is made by loosening the clamping block which allows the brushholder to move until the correct setting is obtained. The nut which holds the clamping block should be carefully tightened so that the brushholder will not come loose. A piece of fiber, tapered from ¼ in. to 1/16 in. thick, makes a handy gage for use in securing the desired setting.

About 5 lb. of spring pressure per square inch of contact surface is generally considered good practice. This will give a range of pressure on carbons from 4 lb. to 7 lb., depending upon the size and grade of carbon. Other factors that govern this pressure are the amount of sparking, the play in the armature bearings and the track conditions.

To prevent breakage and side wear of the carbons the fit in the box must be made as snug as possible without binding. This clearance should never be allowed to exceed 1/32 in.

The shunt formerly used on the carbon has been replaced by a shunt on the brushholder which connects the contact tip on the finger and the main casting. This shunt must be large enough to carry the current, and the connections at the ends of the shunt where fastened must make good contact and be made permanently secure. The ends may be brazed, soldered or riveted. If a good electrical path is established for the current through the shunt much of the side wear of the carbons and burning of the carbon box is prevented. Therefore it is very important to keep the shunts in good condition.

The object of the contact tip is not only to transmit the pressure to the top of the carbon, but to conduct current from the shunt to the carbon or from the carbon to the shunt. The shape of the contact tip should be such that it will do the least damage to the top of the carbon and provide a large contact area to carry the current. A flat tip about 1/16 in. thick gives very good results in service.

Cable leads should be supplied with sleeves or terminals and connections should be kept tight by means of jam nuts and lock washers on the set screws to secure a good electrical as well as mechanical contact.

Carbon dust and dirt in the working parts of a brushholder usually cause it to work stiffly. These parts should, therefore, be kept clean and occasionally lubricated. If neglected they either become tight and do not provide enough pressure or they become so badly worn that the parts get out of line, causing the tips to press on the carbon box instead of the carbon.

Carbon Brush Selection Is Difficult

It is difficult to select a grade of carbon brush for railway motors by a casual inspection or any simple tests. To secure the right brushes requires a thorough knowledge of the various grades of carbon, backed up by long experience in service, and even then unsatisfactory applications are sometimes made. When a selection is being made a few fundamental operating conditions should be considered, such as commutation, life of commutators, life of brushes, frequency of inspection, current density and cost per car mile.

These factors will vary more or less with the design of the motor, the brush tension, the design of the brushholder, the location and spacing of the brushes, the condition of the roadbed, the condition of the equipment, armature bearings and commutator surface, the weight of the car, the number of motors per car, the scheduled speed and many other conditions.

Since all of these factors must be taken into consideration, the best and most reliable results are obtained by making a test of recommended grades in service under actual operating conditions. Carbon brush manufacturers generally are willing to assist the operator in making such service tests. The following general information regarding carbons will help the operating man more intelligently to select carbons for service tests.

Classes of Carbon Brushes

By the use of carbon in the form of graphite and coke the following general classes of brushes are manufactured and available for railway work: Carbon brushes made of crushed coke and binder, graphitized brushes made of carbon and then electrographitized, and graphite brushes with natural graphite and binder.

For the modern commutating-pole railway motor having commutators undercut, with due consideration of costs per car-mile, brush end wear, side wear, breakage, life, commutation, life and maintenance of commutator, etc., the brushes which are best suited for railway motor service are graphitized brushes, which give the best all-around results. Carbon brushes are next best, while graphite brushes have very special and limited uses.

For use in the more modern brushholders the carbons should not be over 2 in. long when new and they should not extend above the top of the carbon box. If longer they are subjected to a greater side pressure, due to the action of the contact tip, which increases the side wear, tends to bind the carbon in the box and reduces the direct pressure on the surface of the commutator. This excessive side wear causes them to be discarded before the added length can be used up in end wear. Approximately the same mileage can be secured from the shorter carbon, and hence, since the carbons are bought on a cubic-inch basis, the first cost is less.

The width of brushes is not so important; they can have as much as 1/16 in. clearance in the box without causing any trouble in service. The thickness, however, is very important, for if the initial clearance between carbon and carbon box is much less than approximately 0.006 to 0.008 in. the carbon will tend to stick in the box and bind. If it is greater, rattling in the box will ensue, quickly wearing away the sides of the carbon, which will also tend to chip and break, thus reducing its life.

Mr. Masuda, the newly appointed chief of the street car section of the Municipal Electrical Bureau of Tokyo, Japan, is having his hands full of labor problems. The men want improved working conditions, but so far the proceedings have consisted largely in exchange of words, and demonstrations by the men.

Using Brazed and Welded Bonds

The Various Methods Used with Contact Resistance, Arc Weld and Gas Weld Rail Bonding Are Described and Some of the Troubles Experienced Are Detailed

By G. H. McKELWAY
Engineer of Distribution Brooklyn Rapid Transit Company

WHILE the troubles experienced with bonds have been many and varied, few if any of them can be laid to high resistance of the conductor. That trouble disappeared with the general use of copper as the metal from which the bonds are made. The breaking of the strands or ribbons of the bonds is still a source of considerable trouble, but in most cases this is due to poor design of bonds which are necessary to fit some special condition, due to unsuitable joint plates or drilling, or to the installation of bonds of proper design on poorly maintained rails. Excessive movement causes breakage, but it is necessary to protect the bonds from theft, and so they must be placed under the plates.



WELDING BONDS WITH ROTARY CONVERTER MOUNTED ON CAR

The strands of some bonds are broken soon after installation, because although the bonds have been suitably designed for normal conditions they are used on installations where the bond holes cannot be drilled the proper distance apart, and as a result the bonds have to be squeezed into all sorts of queer shapes to make them fit into the space assigned to them. An accompanying illustration shows one such installation where, on account of its temporary nature, it was not thought worth while to purchase bonds of the right length, but instead those that were in stock were used.

The great trouble, however, has not been with the conductors connecting the two terminals of the bond nor with the terminals themselves, but rather with the deterioration of the contact between the terminals and the rails. The most intimate contacts are obtained by fusing or welding the terminals to the rail. This results in what is practically an alloy of the two metals where they touch each other and an attachment is produced which is almost impossible to separate. If the bond is pulled away from the rail it will be damaged and part if not all of the terminal will be left adhering to the rail.

Such a connection would appear, at first thought, to be the ideal one, but, like all other methods of bonding, it is not perfect, although for much work it is more nearly perfect than any of the other forms. In the first place the equipment required to install the bonds is much more bulky than that needed for any of the other bonding processes. The class of labor represented by the bonders must be at least as high and preferably higher than that required for the installation of the soldered bonds and much higher than that needed for putting on the expanded terminal bonds. Furthermore the temperature to which the bond and the rail both have to be raised is much higher than that needed for sweating on the soldered bonds, and there is danger of overheating and making either the copper in the bond brittle or the steel of the rail so soft that it may be deformed by the blows from the wheels passing over the joint. The head of the rail receives hard service under any condition, and where the receiving ends of the rails are low conditions are rapidly aggravated if the composition of the steel is changed by overheating.

There is, however, no danger of overheating if care-



600-VOLT RESISTOR OUTFIT FOR ARC WELD RAIL BONDING



RESISTANCE GRID MOUNTING FOR USE IN CONTACT WELDING

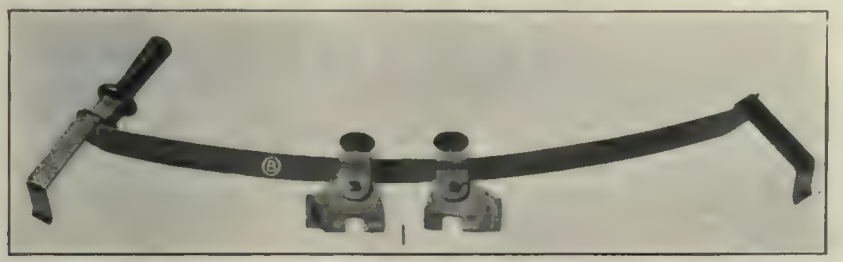
ful, competent bonders are employed, as has been proven by results from many thousands of bonds installed by this process. The danger, however, is always there.

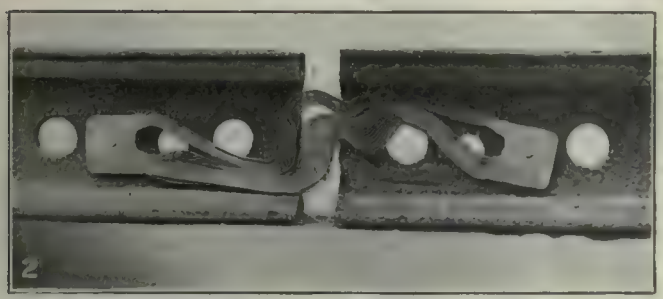
There are two general ways of generating the heat needed to apply the bonds. In one the passing of current at low voltage through the bond and the rail heats both of them to such an extent that the copper bond can be brazed to the steel rail. In the other method the heat is applied by means of an arc, the arc being made either with electric current or with burning gases.

Of the two methods the one using the resistance of the contact between the rail and the bond is the older, but requires more cumbersome apparatus than the arc method, especially when the low-voltage current is produced by an "inverted" rotary converter mounted on a car. This changes direct current at railway voltage into single-phase alternating current at a voltage which is reduced through a step-down transformer.

Two sizes of rotary converters are used, one of 18-kw. capacity and capable of welding bonds up to 350,000 circ.mil section and the other of 30-kw. capacity, which can be used with 500,000 circ.mil bonds or with bonds of even greater section. When it is desired to move the car from point to point the rotary can be used as a motor, a clutch and chain being provided for transmitting the power to the wheels. For covering long distances it is claimed that speeds up to 30 m.p.h. can be obtained. With such speeds there is no reason why the line should be blocked or traffic delayed while the car is traveling to and from the point where it is working.

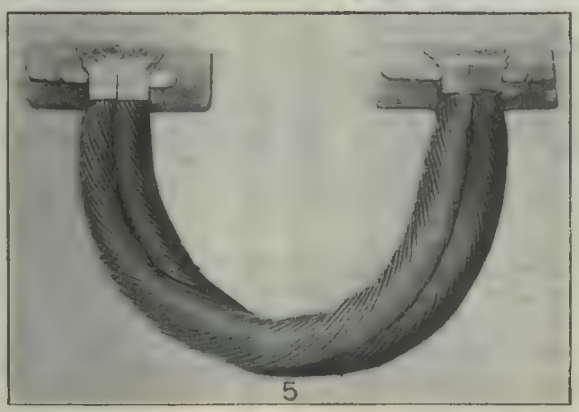
While welded bonds can of course be applied to any portion of the rail, it is much more common to install them on the head than anywhere else. Those portions of the head against which the terminals rest are first cleaned with a motor-driven grinder. The terminals, covered with a piece of sheet brass folded around each one, are first painted with borax and then placed against the rail and held there by being clamped between the carbons. Current is then applied, heating the rail and the bond terminal and also melting away the piece of strip brass which is used for brazing the terminal to the rail. To fasten one terminal of an ordinary No. 0000 bond securely to a rail requires about 2,000 amp. at 5 volts for a period of approximately one minute. The time taken for welding both terminals is two minutes plus an allowance for the time spent in moving from one bond to the next and in getting the carbons accurately located at the points where the terminals are to be installed. There is also a little time lost in clamping the bond onto the rail. As a result, the time required to put on a bond will vary from four to six minutes and the latter rate of













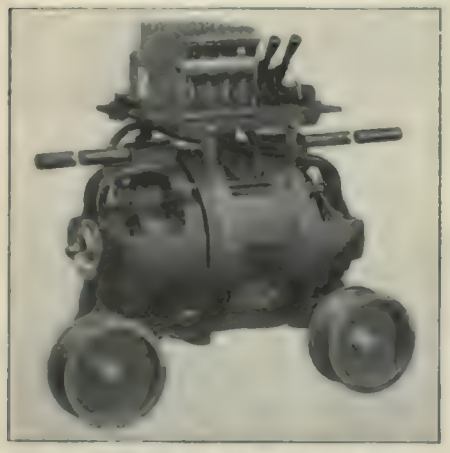
No. 1—Clamp for holding bond in position while it is being welded.
No. 2—Bond shaped to meet special conditions in temporary track.
No. 3—Welded terminals adhering to rail after conductors have been torn away.
No. 4—Installation of bonds on ball and base of rail.
Nos. 5 and 6—Gas-weld bonds with steel terminals.

TYPES OF WELDED AND BRAZED BONDS

ten bonds per hour is a good standard for straight undisturbed work covering several hours.

The welding cars are equipped with a turntable jack attached under them, so that, if necessary, bonding can be done under traffic and the car can be removed from the tracks when a passenger car approaches. When bonding is done by this method only about half the number of bonds can be applied in the same time that can be put on if the car is worked continuously. To remove the car from the tracks it is jacked up, turned at right angles and then pushed off the track by using two pieces of channel iron as temporary rails. Large cars, however, are too heavy to be handled in such a manner by their ordinary crew, so that they must work continuously.

When this outfit is used on lines that have not as yet been electrified and that are being bonded in anticipation of such electrification, instead of the rotary converter being mounted on the car its place is taken by a low-voltage generator driven by a gasoline engine. In order to render the welding outfit lighter and more easily handled, one company has designed a welding equipment with resistance grids mounted on a frame running on four wheels of small diameter or placed on a cart. The frame is light enough to be lifted off the track and the clamps are not attached directly to it, but receive the current through flexible leads running from the grids to them. This arrangement makes it unnecessary for the frame to be kept on the tracks while the terminals are being welded to the rail.



DYNAMOTOR FOR APPLYING BONDS TO RAIL.

This apparatus has the great advantage of lightness, but has the disadvantage of wasting much power in the resistance and of being liable to damage the trolley wire by overheating, on account of the heavy current being drawn from the single wire at a single point by means of a contact that is not always a good one.

TWO METHODS OF ARC WELD BONDING

The methods of welding the bond terminals to the rails by the use of an arc can be divided into two general classes, depending upon whether the arc is made by electricity or by the flame from a gas torch. The electrical method can be still further subdivided into arcs drawn from current supplied by a low-voltage dynamotor or motor generator and those in which the trolley current is used and resistance is placed in series with the welding terminals.

When the dynamotor is used a specially constructed light-weight type furnishes the current. This machine is mounted either on a light cart or on a low carriage normally resting on the rails, but so light that it can be picked up and placed at one side of the track out of the way of traffic when desired.

The bonds are merely copper ribbons bent into U-shape, with the ends of the ribbons surrounded by strips of copper to hold them in place. Bonds are applied vertically to the head of the rail, being held there temporarily before and during the process of welding by clamps which act as both clamps and molds and are kept in place on the rail by a thin steel strap which acts as a spring. An arc is drawn between the rail and the carbon electrode. The copper terminal of the bond is fused with the steel of the rail and additional copper besides that in the bond itself. The heat not only welds the copper to the rail but melts the copper in the ends of the ribbons into a solid mass, so that when the mold is removed there is a lump of copper at each end of the bond fused directly to the rail and into which all of the ribbons are fused.

When neither a rotary converter nor a dynamotor is used for reducing the voltage the reduction is obtained by placing resistance in series with the arc and so cutting down the voltage that at the arc it is only a small proportion of the trolley voltage, although even then at the arc the voltage, with the use of resistance in series, is much higher than when the dynamotor is used. A typical resistor is shown in one of the accompanying illustrations.

The bonds for arc welding by this method are much similar to the ones made for use with the dynamotor, but are made in two general types, one all copper and the other with copper strands but with steel or steel-covered terminals. If the all-copper bonds are used they are brazed to the rail by means of a special flux wire, as is done when the revolving machinery is used to transform the current. However, the better method is to make use of the steel or steel-covered terminal and then to attach the terminal to the rail by melting down an iron rod used as a welding terminal and combining that iron with the steel of both the rail and the bond terminal. A pure iron rod, such as the "Armco" iron, is needed and the rod should be about ⅜ in. in diameter. With such a rod a current of approximately 150 amp. will give the best results.

CLEANING IS ESSENTIAL

The rail is first cleaned with a grinder or a wire brush and then the bond is clamped in position with either an ordinary C-clamp or one shaped like that shown in one of the illustrations. The bond manufactured by one of the large bond companies consists of copper terminals surrounded by Armco iron shells brazed to the terminals and with sleeves of the same material to protect the wires where they leave the terminals. The welding of the copper to the steel is done at the factory, which insures a better job than when the work is attempted in the field. After the bond has been clamped to the rail it is welded there by the arc and the metal melted from the rod is deposited so as to form a triangular mass above the top of the terminal. The sloping form of the metal above the terminal not only adds strength to the attachment of the bond to the rail but prevents the bond from being sheared off if struck by the wheels of wagons or automobiles, and is a patented feature of this bond.

The electric arc is not the only one used for attaching bonds to the rail and many bonds are put on by the use of oxy-acetylene torches. These torches do not make so hot an arc as does the electric current, but it is hot enough for bond welding, and as it is more easily

controlled than the electric arc it is for that reason preferred by many engineers, even when they can use electricity for welding. It is, of course, the only type of arc welding that can be used on new track before it has been electrified, unless one of the few gasoline engine driven units which have been manufactured is used.

With this equipment the scale on the rail is first burned off with the arc or removed with a grinder or brush, and then one end of the bond is clamped to the rail by means of a C-clamp. While the scale can be burned off very quickly, probably a cheaper job can be made if a grinder is used. Both all-copper bonds and copper bonds with steel terminals are applied by this method and both types of one make are so shaped that there will be a little room between most of the terminals and the rail so that the fused metal can run down between the rail and the terminal and join them. This also permits the gases to escape.

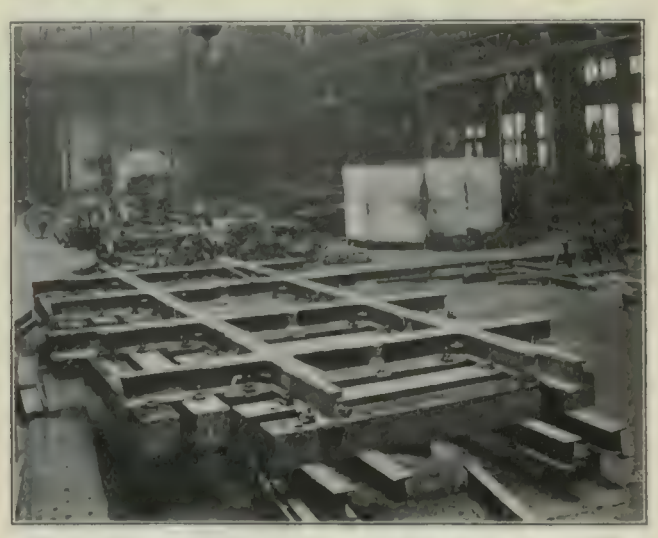
Another type of steel terminal bond used has the head beveled off. With this type the apex and not the base of the triangle is placed next to the rail and metal is filled in until the terminal assumes a rectangular shape. When a bond of this later type is used there is no necessity of having two kinds of bonds in stock, one to be attached vertically and the other horizontally to the head of the rail, as the one bond can be placed in either position, which permits of bonding "Weber" joints as well as those with the other types of joint plates.

Solid Chrome Nickel Steel Special Trackwork

Milwaukee Company Developed This Type of Construction During the War as a Substitute for Solid Manganese—It Has Some Advantages and Apparently Good Wearing Qualities



ASSEMBLING THE CHROME NICKEL STEEL CAST CROSSES, AFTER MACHINING, FOR WELDING THE JOINTS



A HALF DOUBLE-TRACK, DOUBLE-TRACK CROSSING WELDED IN ONE PIECE AND MOUNTED ON FOUNDATION TIMBERS AND RAILS AT THE SHOP

DURING the war, when solid manganese steel special work became very expensive and very difficult to get at any price the Milwaukee Electric Railway & Light Company undertook to develop a substitute. The investigation was carried through considerable experimentation, out of which was evolved a chrome nickel steel having a composition which seemed to offer the desired qualities. To date three double-track crossings made up from solid chrome nickel steel castings have been installed and a fourth one is now being made. These embody a number of unique features in connection with the method of construction and installation.

The formula finally determined upon for this special work steel was as follows: Carbon, 0.35 per cent; manganese, 1.00 per cent; phosphorus, 0.03 per cent (max.); sulphur, 0.04 per cent (max.); silicon, 0.15 per cent; chromium, 0.55 to 0.60 per cent; nickel, 2.30 to 2.50 per cent.

The crossing for each single track was cast in four pieces (four crosses) in order that the machining could be done on the largest planer available in the company's shops. If a large enough planer were available it would be desirable to cast each single-track crossing in only two pieces, thus avoiding two joints. The castings were made in a local steel foundry in basic electric furnaces and all machine work was done in the company's own shops, though now that the development work has been completed an effort will be made to have future special work built by manufacturers.

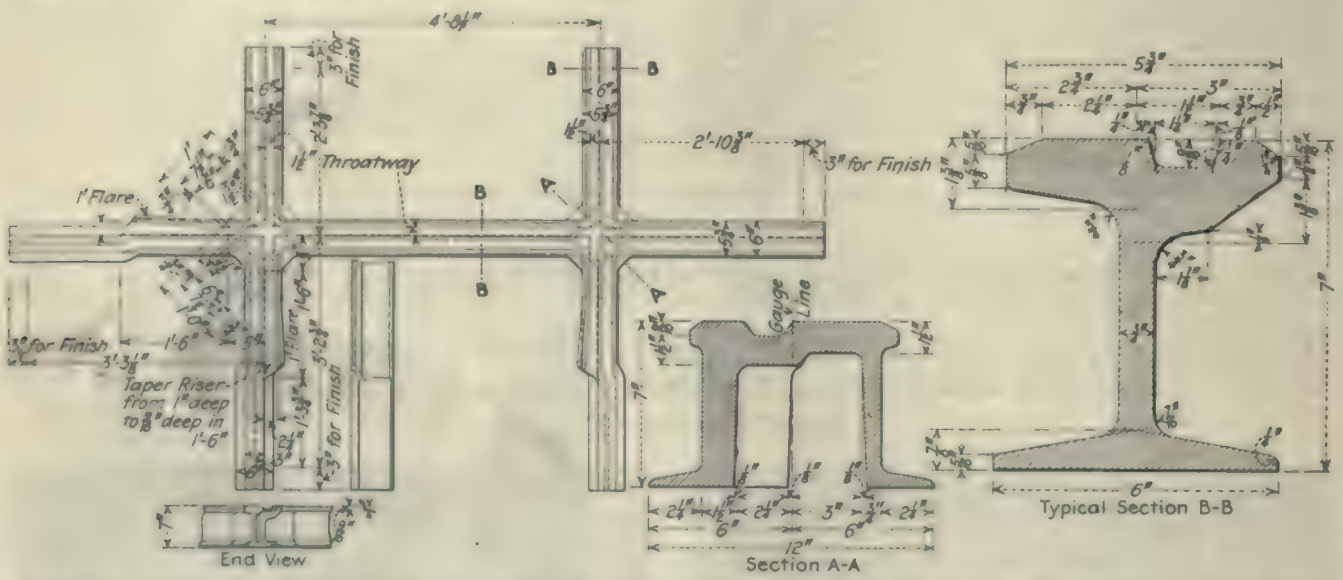
After the machine work was completed the four pieces for one single-track crossing were thermit welded together in the shop at the four joints and then two of these complete crossings welded together at their two joints. This half-double crossing was then through-bolted in the shop to 8-in. x 8-in. and 8-in. x 12-in. white oak timbers, the larger timbers being used for those positions coming directly under the rails, in order to give a width outside the rail base sufficient for the bolt holes and rail clips. A double-

track, double-track crossing with its foundation was thus made up and transported to the location at which it was to be installed in two pieces, so that of the forty joint welds to be made only twenty had to be made in the field.

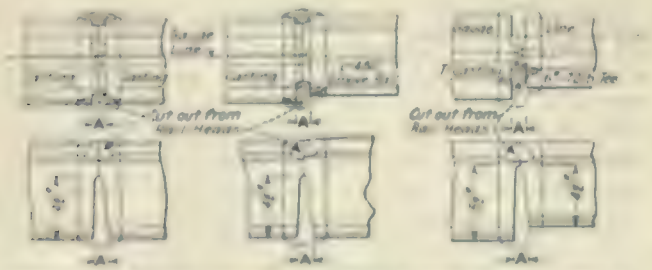
Upon reaching the job the two pieces forming the complete intersection were set in place by means of a derrick car, blocked up to grade and alignment and concreted in. On some of the intersections thus made up additional foundation strength was provided by bolting several sections of old rail, inverted, to the bottom of the timbers, fastening them by means of separate through bolts and clips. Where these were used they were also bolted in place before the special work left the shop.

It will be noted that all joints were thermit welded and that no bolted joints whatever were used. This is considered one of the material advantages offered by this new type of solid special work, for it has been the experience of the Milwaukee company that the difficulty of matching up and grinding joints between solid manganese special work and the adjoining rails in order to secure a perfect joint, and, further, the dependence on heat-treated bolts to hold the joints in place are the principal sources of trouble. In other words, it is necessary to use materials in the joints that are inferior to those in the special work.

An interesting feature in connection with the chrome nickel steel crossing is that the crossings were made with flange bearings entirely across the special work. Sufficient metal was left in the flangeway to permit a wear of ½ in. before the tread of the standard wheel will touch the rail head. One of these crossings installed at West Water and Sycamore Streets, which is one of the heaviest intersections in the city, showed a wear in the flangeway of ⅛ in. after being in service eight months. It will be noted from an accompanying drawing that the cast rail section used in the special work casting is not standard, but is reinforced under the flangeway to provide for the stresses incurred through the flange bearing.



DRAWING SHOWING STRUCTURAL MAKE-UP OF THE SPECIAL WORK CASTING AND SECTIONS THROUGH THE ACTUAL INTERSECTION AND THE GROOVE RAIL



METHOD OF PREPARING RAIL ENDS FOR THERMIT WELDING TO ELIMINATE THE INSERT

While these nickel chrome steel layouts have not been in service long enough to determine their wearing qualities relative to those of solid manganese steel special work, the first one having been installed in April, 1919, there are certain observations which may be made now in comparing the two. The nickel chrome steel special work has the threefold advantage that it can be machined instead of ground, that it can be welded at the joints instead of bolted and that it may be built up with an electric welder at the intersections without destroying the hardness of the metal and producing brittleness, if repair work becomes necessary. As to the relative cost, that for the metal alone is about the same. There is probably some saving to be realized in the machining process as compared with grinding. And if the wearing qualities of the nickel chrome steel prove to be somewhere near as good as those of the manganese steel, it may be assumed that the maintenance cost will be materially lower because of the elimination of the bolted joints.



CHROME NICKEL STEEL SPECIAL WORK SHOWING COMPLETE FLANGE BEARING AND NO BEARING ON RAIL HEAD

With the adoption of the nickel chrome steel special

work for heavy traffic locations the Milwaukee company will have standardized upon two types of construction. Cast steel-bound special work without manganese plates is made use of very generally except at the heaviest traffic locations, where the solid-steel crossings are used. Very good success has been had with the steel-bound type, not a single break having occurred in three and one-half years, with a good many installations in use. The Milwaukee company is using thermit welds to a limited extent in making repairs to special work and has made up some frogs by this method, as described in the ELECTRIC RAILWAY JOURNAL for Dec. 20, 1919, but it is continuing to use the steel-bound construction for the bulk of its replacements.

In conection with the use of the thermit process of welding joints in special work an interesting scheme has been devised to eliminate the necessity for the insert which is commonly employed. The need for this insert has been overcome by cutting away the ends of the two rails at the base and underneath the head, as shown in an accompanying drawing. This permits the metal to flow into and become an integral part of the web, assuring a positive weld without the insert.

Illinois Utilities Committee Report on Valuation and Return

IN ORDER to encourage the necessary investment in public utility securities two things must obtain: First, a fair valuation of property and, second, rates sufficient to pay an adequate return over and above expenses. This is the fundamental statement of the committee on valuation and return of the Illinois State Electric Association, Illinois Electric Railways Association and Illinois Gas Association, acting jointly. It is claimed that more than $40,000,000 is needed to pay for the extensions and improvements which should be expected from purely local public utilities of Illinois, and if the cities and communities are to thrive and prosper the public utilities must expand to meet the increased demand made upon them.

In making recommendations the committee starts with commendation for the report of the valuation committee of the American Electric Railway Association. It states as a necessary fundamental that a utility is entitled to a just and reasonable, as distinguished from a merely non-confiscatory, rate, and urges the development of this point in the presentation of all public utility rate cases.

The other recommendations of the committee are that in all cases the evidence be fully presented; that utilities should submit appraisals of physical property based on the cost to reproduce new at prices prevailing at the date of inventory, and that the commission be urged to adopt the same as the present value of such physical property; that if the commission or any other party submits an appraisal based on the original cost or cost to reproduce at any other period than the present, the utility should produce evidence showing the difference between the purchasing power of the dollar used in such appraisal and the purchasing power of the dollar current at the present time; that there should be no deduction for accrued theoretical depreciation; that a full and fair allowance should be made for going value; that the item of income taxes be considered a deductible expense; that all valuations should be itemized and that commissions should itemize their findings accordingly; that a sufficient amount of working capital should be shown necessary and that replacements and contingent reserves be set up.

The committee also suggests that each utility file copies of all briefs submitted to commissions with the secretary of the Public Utility Association, in order to encourage full co-operation and also a complete understanding.

Storms Increase Motor Failures

A General Analysis of Some Equipment Failures Occurring in Parts of New England Visited by Heavy Storms of Past Winter

BELIEVING that the experiences of a few typical electric railways as to the effects of the recent snowstorms upon equipment would be of assistance and interest to master mechanics and others, the editors of the ELECTRIC RAILWAY JOURNAL have made a special effort to obtain such information. The reports received indicate that the equipment failures in those parts of the country which were visited by the heavy storms were most severe. Many railway properties have tabulated the various equipment failures for the purpose of study, and in the accompanying table the numbers of armature failures that occurred on four New England electric railways are given. The total number of failures for the several weeks from Jan. 3 to March 6 are given, with the ratio per cent that this number of failures bears to the total number of armatures in service. The total number of failures for this period varies from 24.5 per cent to 52 per cent. Perhaps the most interesting feature brought out by this comparison is that, while the first trouble is due to overload and the roasting of insulation, by far the greatest trouble comes from the fact that the deteriorated insulation becomes wet and easily breaks down, thus causing grounds and short circuits.

The greatest number of failures occurred during February. At the beginning of the month there was in the New England district a considerable accumulation of snow and ice on the ground, which had resulted from the weather conditions during January. No unusual difficulties, however, were experienced on account of the January storms, but the storm which commenced Feb. 4 and continued all through the next day and until the middle of the afternoon of Feb. 6 resulted in the greatest percentage of failures. Several other storms which were not quite so severe but which added greatly to the difficulties of operation followed this initial storm. The storm which began on the night of Feb. 4 consisted of semi-frozen slush which became saturated shortly after falling. Before nightfall on Feb. 6 the snow turned to a cold rain and then froze to almost solid ice. This storm was accompanied by a wind of nearly 32 m.p.h. velocity, and in spite of its wet condition the snow drifted badly.

FAILURES OCCURRED WITH ALL TYPES

In the tabulated results which have been received by the ELECTRIC RAILWAY JOURNAL so far the number of troubles with each type of motor is given. An attempt was made to group these failures according to the age of the equipment, but this did not bring out any information which would lead to definite conclusions. The number of failures even with the same general type of equipment varies through a wide range, due to the various conditions which are encountered. Thus one

road or even one line of a particular road may have used up its motors and burned out the windings by bucking snow. Another line or road may have been forced to operate its equipment through water to an excessive depth, and this, entering the motors and bearings, causes grounds and short circuits. When cold weather follows the thaw the water which has entered the bearings becomes frozen and shuts off lubrication. This results in the bearings becoming hot and the armatures are let down so as to rub the pole faces, thus damaging the windings and tearing off the bands.

Another factor which ultimately makes itself evident in the number of equipment failures is the amount and type of vehicular traffic which operates on the car tracks. In removing snow some roads clear to the pavement, while others prepare a snow roadway. The effect on the equipment must necessarily be different in the two cases. The drainage conditions of the various railways also have an important bearing upon the amount of water which accumulates on the tracks through which the equipment must operate. Some roads experience difficulty with the lifting of the tracks or pavements by frost. This results in damage to the motors and gear cases from rubbing. Other roads do not encounter this trouble. The diameter of the wheels on the cars is another factor which must be considered in connection with the failures resulting from snow conditions. One road reports no trouble on cars with 33-in. wheels, while it had considerable trouble with motors on cars with 26-in. wheels. In this case it was found that the insulation on the motor windings was roasted out. This was caused by bucking snow, but more particularly by the dragging of the motors over the high surface of ice that accumulated between the rails.

In considering the troubles which have occurred to the ventilated motors of the latest type it appears that several roads have had considerable trouble due to drawing in of snow by the fans. This snow is deposited in the motor frame and around the brushholders. After a thaw the accumulation freezes and forms a solid cover of ice. The application of covers to the motor in several instances has proved of great advantage. By far the greatest trouble experienced with ventilated motors, however, has been caused while bucking snow. The ventilated motor does not have the same capacity for overloads as the older non-ventilated motors, and as most snow bucking is done at low speed the advantages of the fan ventilation are lost. There is no doubt that the amount and quality of snow-clearing equipment which the various railways have in operation has a considerable effect on the number of failures which occur in the operating equipment. If railways can keep their lines properly cleared of snow the resulting equipment troubles are not excessive.

Severe Problem of Keeping Lines Open

The problem of keeping a line free from snow and keeping cars running during a storm on most systems resolves itself into keeping the snow-clearing equipment in operation. In the storm which began in the New England section on Feb. 5 the snow contained considerable moisture and packed readily. Even the breaking down of a truck on the track in front of a snowplow for a short time was sufficient to cause the snow ahead of the snowplow to become packed by vehicular traffic, so that its removal could only be accomplished by the use of picks in the hands of a gang of laborers. Another one of the storms was accompanied by a storm of sleet and rain which froze as it fell. The trolley wires became laden with this ice and a large number of breaks occurred, so that power was actually cut off from the line and the snow-clearing equipment could not operate. Such conditions as these give the operating companies the greatest amount of trouble.

ARMATURE FAILURES CAUSED BY EXTREME WEATHER CONDITIONS

	Road No. 1		Road No. 2		Road No. 3		Road No. 4	
	Number Armatures	Per Cent Failure to Total	Number Armatures	Per Cent Failure to Total	Number Armatures	Per Cent Failure to Total	Number Armatures	Per Cent Failure to Total
Armature in service	4,297	.....	2,554	.....	1,324	.....	1,012	....
Failures for Weeks Ending: Jan. 3	32	0.75	26	1.0	18	1.35	8	0.79
Jan. 10	111	2.6	32	1.24	21	1.58	26	2.6
Jan. 17	79	1.85	26	1.0	41	3.1	29	2.9
Jan. 24	189	4.4	45	1.75	72	5.4	36	3.6
Jan. 31	216	5.0	48	1.87	77	5.8	43	4.3
Feb. 7	168	3.9	52	2.03	124	9.3	41	4.1
Feb. 14	182	4.2	94	3.65	99	7.5	55	5.5
Feb. 21	260	6.1	107	4.15	84	6.3	69	6.9
Feb. 28	303	7.1	92	3.58	91	6.9	92	9.2
Mar. 6	293	6.8	105	4.1	69	5.2	55	5.5
Total failures, Jan. 1 to Mar. 6	1,833	43.0	627	24.5	696	52.0	454	45.0

While the damage done to armatures is the most expensive to repair, still the trouble caused by grounded or short-circuited field coils is quite as annoying. In this connection road No. 3, which is shown in the accompanying table as operating 1,324 motors, used 1,263 field coils during January, February and March, and road No. 4 with 1,012 motors used 900 field coils. This is nearly a field coil for each motor.

In connection with other equipment defects one road reports a large amount of trouble from grid resistors becoming open-circuited, caused by the overheating of the grids from the slow and severe operation and consequent splashing with water or slush. This causes the grids to break and the open circuit occurs, usually resulting in a "dead car," which has to be pushed to the terminal with overloading of the equipment of another car. The breakage of gears, pinions, axles and wheels during cold weather is also considerably increased and adds to operating difficulties.

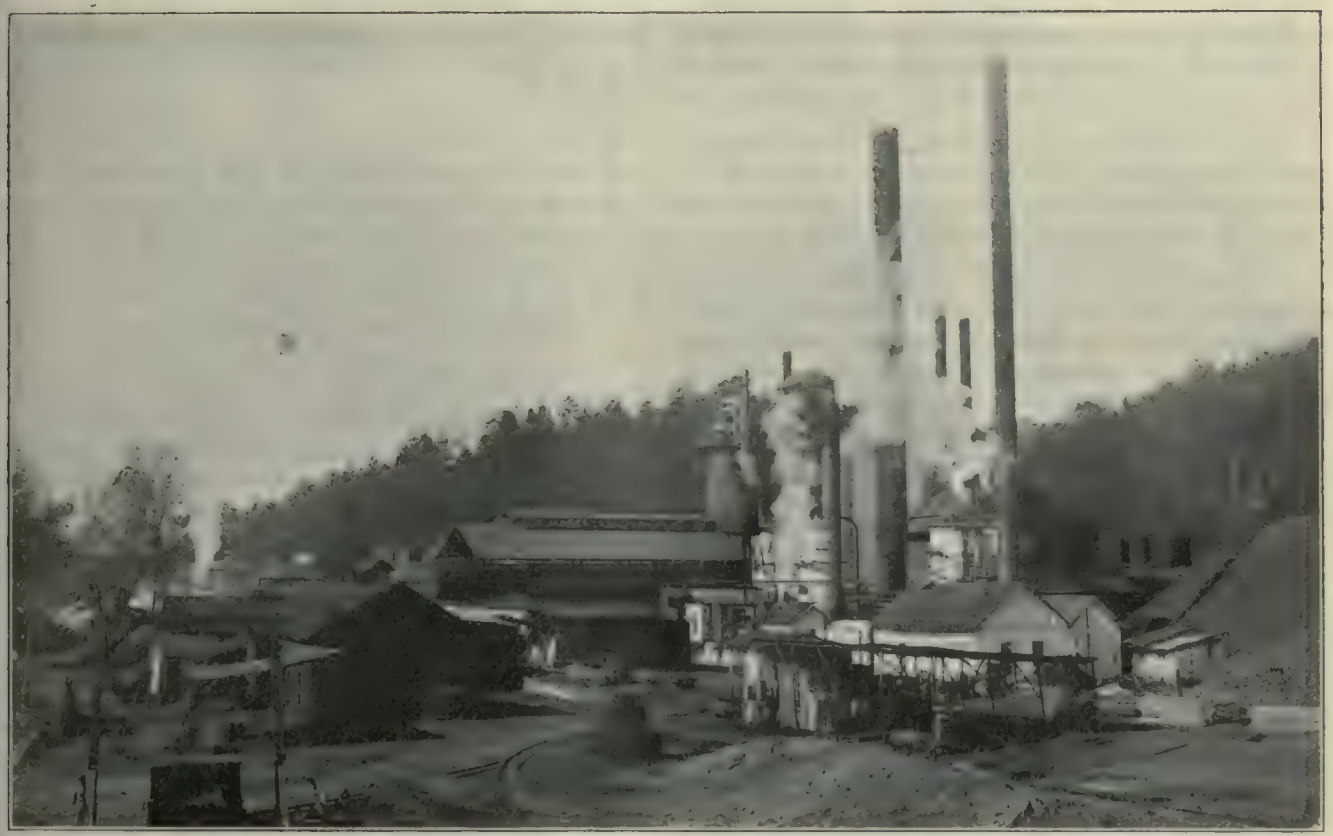
If benefit is to be derived from the experiences of the past winter it must come in the nature of improvements which will prevent the various parts from failing under the extreme conditions of winter service. While a mere enumeration of the troubles that have resulted and a knowledge that others have had as much or even greater trouble may be consoling to some roads, still if desirable results or improvements are to be obtained they must come through the electrical manufacturers.

No Labor Shortage in Kansas City

IN THE trainmen's instruction school of the Kansas City (Mo.) Railway there are from 150 to 200 men at all times to care for the turnover among the 2,600 employees of the transportation department. The labor turnover for the period from December, 1919, to April, 1920, inclusive, following the last strike, was about 300 per cent. Records show that 5,128 men entered the service and 2,881 left. The turnover has now gone back to a point as low as, if not lower than, that in most of the large industries in the city. The present wage, which provides a maximum of 50 cents per hour in the fourth year of service, is attracting men from other industries and there is practically no shortage of man-power to operate the cars.

Railway Car Materials—Steel—I

BY NORMAN LITCHFIELD



STEEL MANUFACTURE BEGINS AT THE BLAST FURNACE

A Comprehensive Statement of the Standard Steel-Making Processes Is Given to Promote a Better Understanding of the Qualities to Be Expected in Steel

The Manufacture of Steel

THE mechanical man of a railroad upon turning to the ordinary text-books for information on the nature and properties of iron and steel finds himself confronted with a mass of information which is confusing. This confusion is unavoidable, because a text-book must cover all of the various fields so that the general student may become informed, or rather that he may be provided, as it were, with a reservoir of knowledge from which he may draw as occasion demands.

There are a number of other sources to which the reader may turn if he desires a more intimate knowledge of the subject, but the writer has felt that a fairly clear idea of the salient characteristics of these materials could be presented briefly and in such a way that the information would be of interest and have reference value. This article is the result. It is not designed to present any strictly new matter but simply to review the subject of steel and to present a general picture of the present situation regarding its production and its utilization in the electric railway field.

To obtain a clear understanding of what is commonly known as iron and steel, it should be borne in mind that all of the varieties of iron and steel, whether cast iron, cast steel, wrought iron, steel in the form of plates, bars and structural shapes, however complex, all start fundamentally from the same source. The initial stage of manufacture of all is the same, namely, the iron ore, which of course is not metallic iron, but the oxide of iron mixed with silica, sulphur, phosphorus, etc., is heated in a blast furnace with coke and limestone. Here the high temperature breaks up the oxide of iron into metallic iron and oxygen gas, the latter immediately combining with the sulphur and other elements. Mixed in with the pure metallic iron are the impurities that were present in the ore, sulphur, phosphorus, etc., although not in as large quantities. Some of these have been given off as gases and others have been fused and, being lighter than the iron, float on top of the molten iron and are drawn off before the iron is poured into molds. The iron so cast contains from 3 to 4 per cent of carbon and is known as "pig iron."

It is impossible to "run" the material in this state, and it is from this point on that the methods of manufacture of the various commercial materials begin to differ. Here the reader should remember that iron and

steel get their various qualities not inherently, as in case of the woods, treated in a previous article, but through the processes to which they are subjected during manufacture.

These processes have been worked out by centuries of experiment, the earliest process of which we have knowledge being that of making wrought iron and small quantities of high-grade steel directly from the ore without the production first of pig iron as above described. This goes back many hundreds of years before the Christian era.

Cast iron is thought to have been made first about the time of the discovery of America by Columbus, but the modern pig-iron products, such as wrought iron and steel, were not produced commercially until the latter half of the eighteenth century. Then in 1856 came the world-shaking discovery by Sir Henry Bessemer of the process now named in his honor for making steel. When we realize what this discovery has made possible the wonder of that achievement stands out as simply colossal. Since that time the advance in the art has been rapid and has made possible the marvelous structures of the last century.

Making Wrought Iron From Pig Iron

In the manufacture of wrought iron from pig iron of proper grade, the latter is heated in a reverberatory furnace with a fluxing cinder (oxide of iron) until both iron and flux melt into a pasty mass. The flame of the reverberatory furnace impinges upon the contents and oxidizes the impurities. The purified metal collects in globular masses which are turned over and assembled by the puddler, then removed from the furnace and a portion of the slag squeezed out. It is then rolled into bars, which are called "muck bars." These bars still contain a great deal of slag and hence are never used commercially, but they are cut up and the pieces are piled and bound together with wires, the bundles being reheated to a white heat (not melted) and again rolled into bars, known as "merchant bars." This is the usual "bar iron" of commerce. When a purer metal is desired, the merchant bars are cut up, repiled, reheated and rerolled into bars, thus forming "double-refined" iron.

To review, then, it will be seen that wrought iron is essentially a material that has been produced by melting the iron to a pasty state in a bath of slag, then removing the pasty iron and rolling it before it solidifies. It consists of practically pure iron mechanically mixed with slag. As it is rolled out into bars the slag is also rolled and gives to the wrought iron its characteristic fibrous appearance.

Steel Is Made in "57 Varieties"

While wrought iron is a simple substance, consisting, as above stated, of pure iron with which a certain amount of slag is mechanically mixed, steel is a complex material consisting mainly, of course, of iron, but this iron has crystals of various other substances imbedded in it, and in some cases the iron is chemically combined with these foreign materials. Furthermore, while in wrought iron the slag is practically inert, in steel the foreign substances exercise a controlling effect on the qualities, which will be considered later. But at the outset we would impress upon the reader the fact that whereas when we say that an article is made of wrought iron the name itself signifies a material whose properties are fairly well defined, on the other hand to merely assert that an object is made of steel means little or nothing, inasmuch as there are as many varieties of steel as there are of pie, and the effect of a poor variety of one is about as deleterious as the other.

In steels which contain but a small amount of the foreign substances, the chemical composition and the physical properties begin to resemble those of wrought iron. We may then differentiate steel from wrought iron by its process of manufacture.

Stripped of all qualifying and explanatory phrases, steel may be considered essentially as a material made by melting pig iron to a liquid state and then adding to it other substances which have been found to increase its strength. The pig iron contained originally about 3½ per cent of carbon. This is burned out during the liquefying process and carbon in the final steel is obtained by direct addition while the iron is fluid.

Bessemer vs. Open Hearth with Respect to Quality

The chief two processes of producing commercial steel are the bessemer and the open-hearth processes.

In the bessemer process the carbon is burnt out of the melted pig iron by blowing air through it at high pressure, until the iron contains practically no carbon at all. The desired percentage of carbon is obtained by adding "spiegeleisen," after the metal is decarbonized. This process does not remove any of the phosphorus and sulphur in the iron, and bessemer steel can only be used in places where a fairly high percentage of these impurities will not matter. On the other hand the bessemer process is the cheapest and the quickest method of making steel.

In the open-hearth process a mixture of pig iron, wrought iron, cast iron and steel is melted in a so-called "regenerative" furnace, for the details of which the reader is referred to any standard works on metallurgy. In this furnace a flame impinges upon the surface of the mixture of metals, melting them but not burning out the carbon except to a limited extent, which may be controlled more or less at will by varying the temperature in the furnace. As the heat progresses samples are drawn off from time to time and the percentage of carbon present is determined either by visual examination of the fracture or by quick analysis in the laboratory. The amount of phosphorus in the finished steel, while not reduced in any way by the burning out process of the open-hearth furnace, can be controlled by selecting the proper proportions of steel, cast iron, etc., in relation to the pig iron. However, by adding lime to the charge the amount of phosphorus can be reduced, and when this is done the operation is termed the "basic open-hearth process," and merely as a matter of distinction (for otherwise the term is meaningless) the process in which lime is not used is called the "acid open-hearth process."

At the present writing it is becoming somewhat the practice of steel manufacturers to use what is known as the "duplex process," in which the process is first started in a bessemer converter and then, before decarbonization is complete, the molten liquid is discharged into the regenerative furnace and the making of the steel is completed by the usual open-hearth process. This cuts down the total time of the melt considerably and thereby reduces the cost of the steel.

Experience with the chief two processes, bessemer and open-hearth, has conclusively shown that the latter is much more reliable in every way than the former, and hence bessemer steel is used only in places where the

conditions do not require a high-grade material. As between the basic and acid open-hearth processes there is probably but little inherent difference, as it is possible to produce good steel by either process.

The foregoing gives but the barest outline of the main features of the manufacture of steel, and is offered simply to indicate in the most general way that ordinary steel is divided roughly into two classes, first, that made by the bessemer process and, second, that made by the open-hearth process, and further that the inherent nature of the processes is such that the open-hearth produces a better and more reliable grade of steel than can be produced by the bessemer process. A considerable amount of electric furnace steel is now being produced, but the large bulk is still open hearth or bessemer or one of its varieties.

Certain factors influence the character of the steel, no matter what the process of manufacture. These are: 1. Chemical composition. 2. Care taken in the manufacturing process. 3. Heat treatment.

Chemical Treatment Is Only One Factor

It will be noted that chemical composition is listed as only one of these fundamentals of the character of steel. We emphasize this point on account of the tendency of many to assume that a mere statement of the composition will define the characteristics of the steel, which is not the fact. It is, however, the basic factor. From a chemical standpoint steels are grouped roughly into two classes; carbon (or ordinary) steels and alloy steels.

By "carbon steels" are meant those steels whose physical properties are determined largely by the proportion of carbon which they contain, while "alloy steels" are those in which the effect of the carbon is replaced or supplemented by that of other metallic elements such as nickel, chromium, manganese, vanadium, tungsten, etc.

Considering first the carbon steels, it must be recognized at the outset that the presence of carbon plays a part totally disproportionate to its numerical content. That is to say, the total percentage of carbon even in the so-called "high carbon" steels will not run, except in rare instances, over 1 per cent, whereas the tensile strength of the material will have been increased from about 45,000 lb. per square inch at 0.05 of 1 per cent carbon to more than 150,000 lb. at 1 per cent.

In all carbon steels there is present a small amount of manganese from 0.3 to 0.6 of one per cent, which has been added during the process of manufacture to prevent what is known as "red-shortness," or brittleness of the steel when hot. It further has the effect of causing an increase of about 10,000 lb. per square inch in the tensile strength with the high percentages, but this effect is somewhat incidental. Hence the steel is called "carbon steel" on account of the preponderating effect of the carbon on the strength of the steel.

Silicon from the slag is always present in carbon steel up to a maximum of about 0.4 per cent. It has the effect of increasing the fluidity of the steel, and in small quantities has but little effect on the physical qualities of the steel. Except in some particular instances, such as springs, therefore, the user is not particularly concerned in the amount of silicon which is present.

We now come to the question of the so-called "impurities," sulphur and phosphorus, the presence of which in any large quantity is very undesirable.

Sulphur makes the steel "red-short," causing small, fine cracks in the process of forging, which remain when the metal becomes cold. For this reason manganese is added to the steel, which combines with the sulphur, forming manganese sulphide. While this overcomes the red-shortness, it introduces a new danger, in that the sulphide is apt to collect in streaks which, as it were, break up the continuity of the steel and impair its strength. Hence it is desirable that the sulphur content be kept reasonably low, and fortunately for the user the manufacturer is as a general thing anxious to do so in order to avoid difficulty in the forging and rolling of the material into its finished shape.

Phosphorus, the other impurity, is one in which the user is vitally interested in that any considerable quantity of it reduces the ductility of the metal and lessens the resistance of the steel to shock.

Granting that both sulphur and phosphorus are objectionable elements in steel, the next question is to determine how much or how little can be allowed in the steel without hurting it.

The A. S. T. M. specifications for structural steel for cars, A-11-16, require as follows:

		Structural Steel and Pates for Cold Pressing	Rivet Steel
Phosphorus	Acid	Not over 0.06 per cent	Not over 0.04 per cent
	Basic	Not over 0.04 per cent	Not over 0.04 per cent
Sulphur		Not over 0.05 per cent	Not over 0.045 per cent

The foregoing all apply to open-hearth steel, the use of bessemer steel not being permitted by the specification for car material. In such specifications as those for structural steel for buildings, which allow bessemer steel, the limit for phosphorus is 0.1 per cent, there being no specified limit for sulphur.

Just how the limits given for open-hearth steel were arrived at is not entirely clear, although it seems probable that they were the results of commercial rivalry. It had become evident that the high percentage of impurities as found in bessemer steel was bad from the users' standpoint, and as each improvement was made in the open-hearth steel art it gave the originating manufacturer an opportunity to offer to his customers a product which he and they felt was better than that of his competitors.

As time went on, these competitors made their own improvements, and so the limits of impurities were beaten down to the point where they now rest in the various existing standard specifications.

In fact, during times of slack demand for steel products, manufacturers have been able to offer a much lower limit of impurities, and users are sometimes tempted to feel that because they have been in the habit of receiving this high-quality material, they are justified in incorporating a very low limit for impurities in their specifications. The steel makers claim, and it would seem justly, that such a course is unfair, inasmuch as with an existing top limit of 0.04 per cent, it is necessary for them so to select their materials that they will "aim at," say, 0.03 or 0.35 per cent. In other words, if a specification calls for 0.04 per cent as a top limit, it is probable that a large part of the material will run down to 0.03 per cent or lower. This all requires care and attention in the process of making the steel and often the selection of certain heats or melts, as against others which must be thrown out. Hence, if the user pushes his prerogative too far, and demands a

very low upper limit for impurities, he is apt to force the manufacturer into a position where he must charge a higher price, and the user should therefore be quite certain in his own mind that his service demands an extra special grade before embodying excessive restrictions in his specifications.

War-Time Limits for Impurities

During the period of the war the tremendous shortage in materials made it well-nigh impossible for the manufacturer to maintain his previous standards, and therefore the upper limits of impurities were quite generally raised, the A. S. T. M. specifications in many instances bearing the following notation: "In view of the abnormal difficulty in obtaining materials in time of war, the rejection limits for sulphur in all steels and for phosphorus in acid steels shall be raised 0.01 per cent above the values given in these specifications. This shall be effective during the period of the war, and until otherwise ordered by the society."

It will be noted that, as far as phosphorus is concerned, this tolerance applied only to acid steels, and inasmuch as by far the greater proportion of steel made in this country is now made by the basic process, the matter really comes down to a consideration of the sulphur content.

During the last meeting of the American Society for Testing Materials considerable discussion was had in regard to this matter along two lines, on the one hand whether the time had not now arrived when it was entirely feasible to drop the war tolerance from the specifications of the society and on the other hand whether the extra point of sulphur did not harm the material. As a result of this discussion it was decided "that the forty-three specifications to which this note has applied be divided into two classes: (1) Those specifications from which the note is to be removed at the present annual meeting, as of July 1, 1919; (2) those specifications from which the note is not to be removed at this time, and consideration of its removal is to be deferred until the annual meeting in 1920."

Among the latter group is the specification for car material, and the tolerance therefore still stands.

The second question, that of a general study of the influence of sulphur and phosphorus in steel, is now the subject of joint investigation by a committee representing the A. S. T. M., the United States Bureau of Standards, and representatives of consumers and the railroads. It is planned to gather data both from the mill and laboratory and also from materials in service. This investigation, it is hoped, will throw some light on this subject, which has ever been one of doubt and often of dispute. For the present it may be said, however, that the A. S. T. M. specifications, even with the war tolerance, cover materials which if properly made are suitable for ordinary requirements.

The percentage of sulphur and phosphorus mentioned above are those obtained by analysis made from a test ingot taken during the pouring of the melt. It is generally specified that the purchaser may make analyses from finished material representing each melt. Some specifications, such as that for car material, allow the phosphorus and sulphur content so determined to exceed that of the ladle analysis by not more than 25 per cent. This means that steel made to a specification calling for 0.04 per cent phosphorus might contain in the finished material as high as 0.05 per cent and with the war tolerance of 0.01 per cent as high as 0.0625 per cent. Other specifications require the check analysis to agree with the ladle analysis. In making any comparison of the specifications, therefore, careful note should be taken as to this particular provision, for it is the check analysis which is really controlling.

Further treatment of the chemical composition and physical properties of steel will be given in an ensuing article.

Inspecting Contactors on Multiple-Unit Equipment

IN order properly to inspect the contactors of multiple-unit equipments it is necessary to operate them. This usually requires two men, one to operate the control from the master controller and the other, under the car, to inspect the operation of the various switches to insure that this is proper and in the right sequence. Where repairs or adjustments are necessary a considerable amount of time is wasted by requiring the presence of the operator when his services are not actually needed. Also on multiple-unit equipments which use line voltage in the operation of the contactors it is necessary to have the main switch in and to cut out both sets of motors to prevent the car from moving. Also, during work on the switches, if the main switch is kept in there is an unnecessary waste of power from the current passing through the resistors and an element of danger to the inspector, as the parts are "alive."

In this connection Rowland Hubbard, master mechanic Philadelphia & Western Railway, has found it convenient to have his inspectors operate the switches themselves without requiring the assistance of a man at the master controller. The holding-in circuit for the pick-up coils of the contactors is energized through the line relay contacts. In order to make operation possible without operating the master controller a 10-amp. knife switch has been installed alongside the No. 1 contactor arcing box. When this switch is closed it short circuits the contacts of the line relay so that the pick-up wire is energized for operating the contactors. The location of this switch is handy for the inspector when he is opening up the contactor covers. The line connection for operating the contactors is provided by tapping in on the trolley connection going to the line relay. With this arrangement operation will be accomplished with the main switch out and the motor cut-out switches left in. This arrangement of connections has now been in use for over three years and has proved very satisfactory, as well as providing an additional safety precaution for the inspector.

Paving Charges Keep Up Fares

PHILADELPHIA'S first modern pavement of consequence was provided at the expense of the car riders. Paving costs, including interest payments on the original cost, and maintenance and renewal payments under the agreement of 1907 now total $1,750,000 per annum. This is equal to a 6 per cent return on the outstanding capital stock and must be paid by the P. R. T. patrons as their contribution toward something they themselves never use as car riders. In other words each revenue passenger transported during the year 1919 paid 0.26 cent tax for paving.

Connecticut Zone System Revised

Commission Upholds Principle of Zone Fares, but Disregards Density of Traffic—Makes All Zones Equal—Raises Cash Fare 30 Per Cent and Establishes Two New Ticket Rates—Some Doubt as to the Financial Result

THE Connecticut Public Utilities Commission on April 9 decided that the present system of zone fares in use by the Connecticut Company is discriminatory. The commission pointed out that the zones are of unequal length and that all of the increase in revenue has been at the expense of the suburban rider, inasmuch as the minimum fare for the majority of riders in the larger cities had remained unchanged. This decision was handed down after public hearings extending over several months.

Under the decision the cash fare was increased to 3 cents per zone, with a minimum cash fare of 6 cents for two zones or less. Heretofore, the cash rate in the cities of Hartford, Waterbury, New Haven and Bridgeport averaged 2 cents per mile, while in the suburban and interurban territory the rate was 2.5 cents. The minimum fare for two zones or less was likewise 6 cents.

The order also provides for a reduced-rate zone ticket, which is to be sold in lots of fifty for $1, in order that the regular riders may obtain a lower rate than the casual patrons. These tickets, however, provide a minimum fare for a three-zone ride, but do not allow the passenger to ride at less than the minimum cash fare, because three coupons are the minimum that can be surrendered for a ride.

Commutation ticket rates likewise are established at 1.75 cents per zone between traffic centers having a population of at least 25,000 and the surrounding territory, providing, however, that the points are five zones or more distant.

Abstract of Decision

The decision was the outcome of thirteen petitions and protests from several cities, towns and community organizations. The primary questions involved were as to the reasonableness of the rates, the fairness or practicability of the particular zoning and the system of making fare collections thereunder as had been established and put into effect by the Connecticut Company on Nov. 8, 1919.

Prior to the establishment of the zone system the rate structure had been developed around a flat fare for the larger cities, with multiple zones on the suburban and interurban lines, the rate, however, being the same for all zones, which varied in length from 1.8 to 10.8 miles. On Oct. 1, 1917, the unit rate of fare per zone was increased from 5 to 6 cents, with a proportionate increase in commutation and school ticket rates.

On Nov. 2, 1919, the company established an entirely new schedule of rates based on the length of ride, and at the same time put into effect a new method of fare collection. All tickets, commutation and otherwise, with the exception of the half-fare school tickets, were abolished. Full details of this plan were given in the ELECTRIC RAILWAY JOURNAL for Nov. 8, 1919, page 852.

Petitioners' Claims

The petitioners claimed that the zone rates as established in certain cases increased the fare from 50 to 200 per cent over the previous rates; that these rates were discriminatory in the arbitrary establishment of unequal-length zones and caused abnormal and unequal increase in certain sections and to certain patrons over the long-established flat-rate system under which the communities were developed; that the necessary increase in revenues was undertaken to be collected and obtained from only 33 per cent of the company's total patronage; that the zoning system was inequitable and unfair, and that the method of fare collection was unnecessarily annoying and tended to delay and congest traffic.

The city of Bridgeport also claimed that the railway system should not be treated as a whole, but that the city lines should be segregated from and treated independently of the interurban lines on the assumption that the former were profitable and the latter otherwise.

The Company's Claims

The company controverted the several claims and maintained that it was necessary for the life of the company and to enable it to render proper service materially to increase its revenues over the previous flat 6-cent rate. While no attempt was made by the company to estimate the increase which the zone system would produce, it did maintain that but little if any more revenue would be secured than would be needed to meet the increased operating costs.

The company also raised several points of law, among which were: (1) That the burden of proof was upon the petitioners; (2) that in considering whether the rates are unreasonable it is necessary to consider the earnings of the company as a whole and not by segregated divisions or routes; (3) that the rate schedule is not unreasonable if the receipts are insufficient to pay the operating expenses, fixed charges and taxes, to set aside a proper sum for depreciation and renewals, and to pay a reasonable return upon the investment; (4) that a schedule of rates is not discriminatory if all patrons similarly circumstanced are treated alike; (5) that if by the imposition of the regular cash rates upon all patrons the receipts are or will be insufficient to violate this principle of reasonable rates then any reduction from the regular cash rate is confiscatory, and (6) that no evidence had been introduced before the commission to warrant a finding that the rates as inaugurated are unreasonable, inequitable or discriminatory against any portion of the system.

The Commission Comments

On the above the commission had this to say:

Burden of Proof. In the 6-cent fare case a similar point was raised in which it was held "that inasmuch as the old rates had been in effect for a considerable period prior to those now complained of, and as all of the material facts pertaining to the reasonableness of such rates were more or less exclusively within the knowledge and possession of the respondent, it should proceed by offering whatever evidence it had in justification of its present rates. While the burden of supplying the facts may be imposed upon the respondent, the burden

of establishing its material allegations from all the facts submitted still rests upon the petitioner. The very nature, origin and source of the evidential facts relative to the reasonableness of the rates must modify to an extent the rules of evidence and the burden of proof under the common law. This necessity has also been recognized by Congress in the enactment of the law terminating federal control, in which it is held that the burden of proof is upon the carrier to show that fare increases sought are just and reasonable."

The commission based its conclusions and finding on this theory, holding that inasmuch as the company had submitted without reservation evidence pertaining to the necessity for the increase in rates it should determine, after due consideration of all these facts, as to whether the rates complained of were just and reasonable, and if not to determine what were just and reasonable maximum rates and charges.

Rate Schedules. Claims 2 to 5 inclusive of the company, the commission held, may be fundamentally correct as abstract propositions, but were subject to modification by injection of conditions appearing in this case but apparently not contemplated in the specific claims presented. The sixth claim involved a conclusion of fact based upon all of the evidence submitted.

In the judgment of the commission it is not practicable or even desirable to segregate the several physically connected lines of the company for the purpose of establishing different rates, based upon the respective earning powers of such lines. The intercommunity of social, business and general industrial relations of the State requires that the paying lines should to a reasonable extent help to support the non-paying lines.

The non-paying lines, however, must of necessity have poorer or less frequent service, and a careful study of the traffic on such lines should be made with a view to service curtailment in keeping with the reasonable traffic demands. On certain lines that possibly never should have been built, however, the limited traffic demands and revenue returns may necessitate absolute abandonment unless the lines are subsidized by the towns and districts served.

Commutation or Reduced Rates. The company held that under the State law the commission could establish only a maximum passenger rate, because: (1) The former commutation rate was a privilege voluntarily granted by a predecessor company which the company was at liberty to withdraw at its discretion; (2) the power delegated to the commission to prescribe maximum rates did not include the right to grant any reduction from a reasonable maximum rate; (3) the Legislature itself has no such power; (4) no legal right ever existed on the part of the commuters to a retention of this rate; (5) so far as a moral right is involved, the equities are in favor of the rest of the system that never has enjoyed a cut rate; (6) the discrimination in favor of the commuters was properly abolished by the board of directors, and (7) if the regular rate charged to all is insufficient to pay a reasonable return, no reduction in rate or special privileges can be justified in favor of any particular community.

The commission ruled, however, that the powers and duties delegated by the State Legislature gave it the right to fix railway rates (Turner vs. Connecticut Company, 91 Conn., page 697) and that, under such conditions, it should have at least as much power, latitude and discretion as the company previously had in fixing its own rates. The right of transportation companies to establish reasonable commutation and special rates, unless discriminatory for the particular service, has long been recognized and is also followed by the Interstate Commerce Commission. The principle of commutation fares has also been approved by the State Legislature in the somewhat arbitrary provisions of Section 3,775 of the general statutes, which prohibit railway companies from altering or abolishing such fares after they have been in effect four years.

The United States Supreme Court, it was pointed out, had in several cases also approved of special or commutation rates (see P. R. R. vs. Towers, 245 U. S., page 6). The company contended that street railway service was short-haul transportation and provided a special service for short, almost daily rides, and that a uniform rate was in fact a special or commutation rate and, further, that there should be no cut rates for any class of service. The commission disagreed and held that whatever merit there may have been in this claim under the long-zone or flat-fare system, it was very largely eliminated by the adoption of straight mileage tariff.

Again, if the company's claim was correct, then the commission had no power other than to establish a single maximum rate, irrespective of the amount of service used, and the rate structures of practically every water, gas and electric company in the State would have to be changed, if passed upon by the commission. The commission, however, assumed that the statute did not prohibit the classification of service and for that reason interpreted the statute as authority to determine and prescribe just and reasonable maximum rates and charges for classified services affecting all persons similarly circumstanced, providing such classification was justifiable. The classification of passenger service and the application of a special maximum rate for each classification, it was held, was justified by custom of long standing. It was also in keeping with the principles applied to nearly every successful business enterprise to consider the daily rider, who depended upon the cars as a regular means of transportation, as the purchaser of service at wholesale. As a business proposition such patrons are entitled, the commission held, to better rates than the casual rider, the itinerant who infrequently utilizes the special service provided, or the man who travels in his private automobile or a jitney in good weather, but on stormy days and at times when the automobile is unable or unfitted to negotiate the journey is willing and only too glad to patronize a service that is bound to operate in all kinds of weather.

General Street Railway Conditions

In discussing the question of a proper solution for the almost insurmountable problems confronting the industry the commission recognized that the respondent company had not wholly escaped the chain of circumstances and the countrywide difficulties which have driven many street railways into receivership and have even threatened the continued existence of others.

It was a recognized fact and admitted by evidence that street railways supply a necessary public service and that their suspension would be a public calamity. The commission also recognized that some of the elements that produced the precarious street railway situation in the State of Connecticut were beyond its present power and could only be remedied by special

legislation. Statutory burdens such as street paving, bridge assessments, taxes and unfair automobile competition were among those elements. The labor competition of industrial enterprises, it held, was an economic condition which the carriers must work out for themselves. The depreciated purchasing value of the dollar and the increasing cost of producing service, however, were factors which could and should naturally be met by corresponding increases in rates, but there was a limit at which increased rates would produce increased revenue.

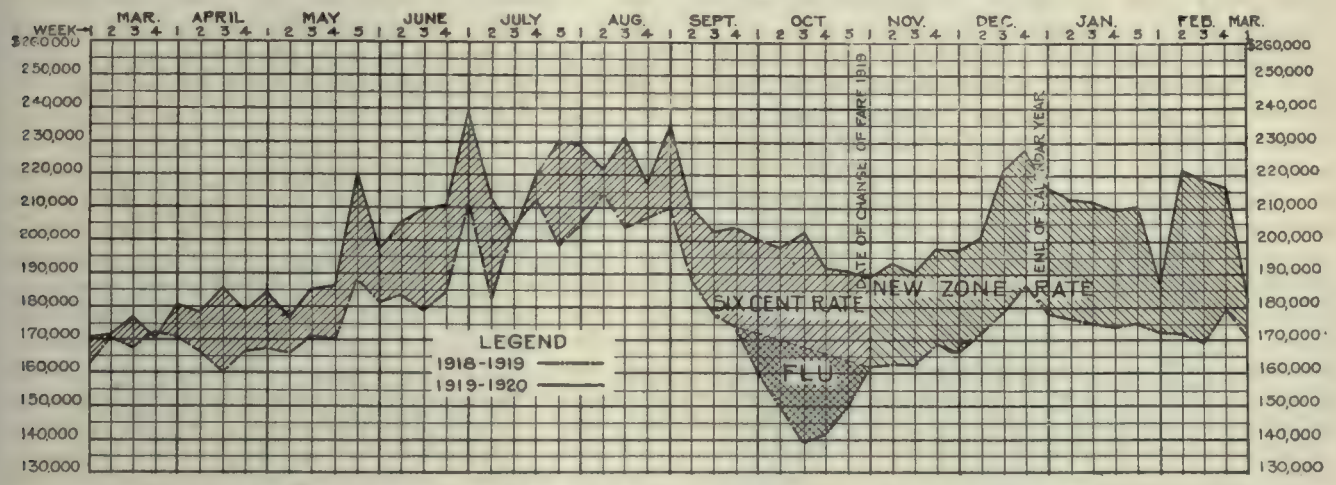
The commission recognized that to perform the duty of any utility company to render good and adequate service the company must be sound financially and any order not based on this general policy would work an injustice not only to the company itself but to the public entitled to receive such service.

A street railway is of direct benefit not only to its patrons but to the communities, business industries and property owners in the localities served, and yet it developed that under existing conditions the car riders were called upon to pay all of the expense of supplying such service. The more indirect taxes a company has to pay to the cities, the towns and the State the greater the fare that must be paid by the car rider. It was obviously unfair, the commission held, to demand that the car rider should assist in maintaining pavements for others when such users contribute little or nothing toward their own comfort and convenience.

To make a rate sufficiently high to cover all such present-day expenses and afford a fair return on the value of the property, taking into consideration the nature of existing competition, would have a tendency disastrously to lessen street railway traffic, even to destroy the usefulness of the carrier in supplying what should be a cheap, convenient and reliable form of transportation available to all the people.

The respondent company even disavowed that its rates were sufficiently high to afford a fair return on the value of its property or upon its investment, but claims it was necessary to increase its rates over the 6-cent flat fare to enable it to meet its present financial obligations, exclusive of dividends. While taking this position the company also claimed the legal right to establish rates that would produce a fair return on the value of the property, and any rate that would not do that could not be found to be unreasonable by the commission.

Rates established either by the company or the commission that fail to produce sufficient revenue to put the company on a paying basis should promptly be increased, assuming, of course, judicious and economical management. Undoubtedly the railway company's board of directors is best qualified to establish a system of rates and collections for its own property, for it has accurate knowledge of the company's needs and an estimate of the results to be obtained by the rates thus established. However, when such rates are admittedly established on an experimental basis, to be demonstrated by public patronage, the directors' prerogatives are materially lessened. Rates established by the commission under such conditions would be as favorable to the company as those established by the directors could lawfully be, for the commission has recognized that in order for a company to render good service it must be on a financially sound basis. Any rates, therefore, as established by the commission that are found to be insufficient should promptly be increased to a maximum such as the traffic will bear, and if such maximum then proves to be insufficient the only alternative is state or municipal aid or abandonment.



WEEKLY PASSENGER REVENUES FROM MARCH 1, 1918, TO MARCH 1, 1920

Reasonableness of Present Zone System

It cannot be found from the facts presented, the commission stated, that the present rates as a whole produce a greater revenue than the company is entitled to, although such a conclusion might theoretically be deduced, due to the fact that a surplus net income after paying interest charges on funded and unfunded debt is shown by the company for the past three years in its income exhibits.

While the company did not present any estimate of the percentage increase in revenue due to the new zone rates for the entire system, it did show that on certain lines and in certain sections it was more than 100 per cent, whereas in other sections there was a loss.

In the mind of the commission, it is a question as to what increase in gross revenue, if any, the present increase in rates has produced over the corresponding period of the previous year, when the 6-cent flat fare was effective. An analysis of the accompanying graph indicates that the 20 per cent increase in fare on Oct. 1, 1917, from 5 to 6 cents, resulted in practically no increase in passenger revenue for the first year. During the second year, however, a gradual increase in revenue is recorded and for the two months just prior to the

adoption of the present rates the chart indicates that the 6-cent fare was producing nearly as great an increase over the previous year (eliminating the effect of the influenza epidemic) as the first three months of the present zone rates.

The commission, therefore, holds that the present increase in revenue is not commensurate with the increase in rates and that the added burden on the public is not relieving the company of its financial embarrassment. Hence, there is no question but that the company must have a greater revenue than is now being obtained. However, in establishing higher rates for the purpose of increasing revenues, the effect upon the public as to the usefulness and reasonableness of the service provided, as well as the interest of the company, must be taken into consideration.

Notwithstanding that the present rates fail to provide a reasonable return for the entire system, the commission holds that they are inequitable and discriminatory and to that extent unreasonable. They are inequitable (1) by reason of failing to give any concession to the daily rider who travels beyond the initial fare; (2) by reason of attempting to obtain the greater part of the necessary increased revenue from a comparatively small percentage of its patrons in suburban sections, (3) and by reason of abnormally high increases to certain of the patrons over and above the system of rates that has been maintained during the past history of the company and upon which they were led to rely as being the more or less universal system which was maintained by nearly all street railways in the country.

The rates are held to be discriminatory by reason of the establishment of unequal-length zones under a distance tariff, particularly the second and third zones, on lines radiating from the same city, and by reason of attempting to measure certain arbitrarily selected suburban zones by the density of traffic while treating the system as a whole and opposing the right or policy of segregation.

Zones. The commission held that the most equitable policy thus far suggested or adopted for street railway fares is the zone or distance tariff system, and accordingly will retain the general basic principle adopted by the company. The evidence, however, presented in the hearings showed considerable dissatisfaction with the zone system, not so much as a measure of rates as the annoyance and delay to traffic. It was admitted, however, that the annoyance and delays were gradually decreasing as the system became more familiar to the trainmen and the traveling public. Most witnesses also testified that the basic principle of charging on the mileage basis for the amount of service actually rendered was more equitable and on a sounder basis than the old flat-rate system with its flagrant inequalities and numerous long-haul rides at an absolute loss to the company. It is true that the long-zone or flat-fare system was more popular and convenient and that it had contributed materially in the past to the building up of suburban sections. The inability of the company longer to continue such a system makes it imperative for the preservation of service to adopt a more businesslike policy, unless the State or municipalities served extend aid. Such aid is not forthcoming at present, and it, therefore, becomes necessary to adopt some other system or a radical modification of the old system.

Opposition to the pay-leave system of fare collection now in effect is based on the theory that it takes longer to unload passengers by reason of the time required in making change, with consequent holding up of street traffic and disarranging of the railway's schedules. Any new and improved system of fare collection is liable to cause annoyance and delay at first, but if practicable will ultimately iron out the minor defects and meet with general approval. Such appears to be the history of the respondent's present system, although the complaint relative to making change still remains to a modified extent. If passengers but knew the correct fare and would have it ready when leaving the car all unnecessary delay would be eliminated.

Statistics as to loading and unloading times per passenger for the pay-enter and pay-leave systems were submitted by the company and these were favorable to the pay-leave plan. The commission is of the opinion that the use of its zone tickets instead of actual cash would very materially expedite the unloading of passengers and assist in the better maintenance of schedules. Comment is also made that under a distance-tariff system no policy of collection thus far adopted or suggested appears to be as practicable as the single collection for the whole ride at the time the passenger is leaving the car.

CONCLUSIONS

Claims are advanced that the increased use of the internal-combustion engine for motive power foreshadows the disuse of the electric street railways in the near future. Even if this were literally true, that time is not at hand, and during such a transition period the absolute needs of the traveling public must be taken care of and the investor safeguarded. The commission, however, has reached the conclusion that even although the motive power may change, as it has in the past, the essential features of a street railway will remain.

Motor vehicles, moving at the will of an operator over the entire surface of the already congested streets, have not yet been recognized or even demonstrated to provide a satisfactory system for carrying all or the maximum number of persons desiring public transportation through the city streets. Consideration must also be given to the fact that such streets are public ways and must be used for other purposes. The public inconvenience and serious consequences resulting from the abandonment of street railway service during the past two years have clearly demonstrated the absolute necessity of preserving and protecting the street railway industry, especially for urban transportation. The commission is, therefore, thoroughly convinced that the street railways render a necessary public service and that any determination of the issues should be made with a view to the proper maintenance of such service, having in mind the respective rights of both the company and the public.

To meet the rapidly changing conditions promptly it is important to have a flexible system of rates that can be varied on short notice without a radical change in the rate structure itself. The commission believes also that the casual rider should pay a greater percentage of the "standby" charge than he now does, and further that the regular rider should be able to purchase transportation at a discount. The sale of tickets at a substantial discount in moderate quantities should invite increased riding, improve the service and promote the interest, usefulness and good will of the company, increase its revenues and bring to its treasury more

nearly 100 per cent of the actual transportation charges.

In establishing a commutation rate, care should be taken not to discriminate, and in no case should the rate be less than the initial cash fare, nor greater than the regular ticket fare for the same distance. To avoid conflict with this theory no low-rate tickets can be sold for short riding. One of the principal reasons for a commutation rate is to enable people working in the larger centers to live outside of the congested area and enjoy the benefits of healthful environment for domestic life. For this reason the commission holds that commutation rates should be limited to lines that radiate from populous, incorporated manufacturing and employment centers of 25,000 population or more. These rates will apply to all points on such lines more than five zones from such traffic centers. The commuter is also entitled to ride, on connecting routes leaving the traffic center, one or more zones in either direction for the regular zone cash fare, irrespective of the initial fare.

PROPOSED ZONING AND RATES

The new rate structure prescribed by the commission contains four different rates applying to zones, each one mile in length. The order follows in full:

Zone System. Establish all zones one mile in length as the track runs, starting from traffic centers and varying the length of the zones only to the extent necessary to absorb or equitably to adjust, by neutral zones or otherwise, a fractional part of a mile occurring in measurements between traffic centers or to line terminals; any dispute as to such variation or adjustment to be referred to the commission.

Cash Fares. Initial cash fare for two zones or less 6 cents, and each additional zone 3 cents.

Zone Tickets. Good on all lines, sold in lots of fifty for $1 or in larger quantities at the same rate if desired. Not fewer than three tickets to be collected for a ride of three zones or less and one ticket for each additional zone in excess of three zones.

Commutation Tickets. Good for a round trip daily between the traffic center of any incorporated city or borough having a population of 25,000 or more and points more than five zones distant therefrom on all lines radiating from such traffic center, for the number of days in any month less Sundays and legal holidays; said commutation tickets to be sold at the rate of 1.75 cents per zone, to be issued to the individual commuter, to be non-transferable and to expire at the end of each month. The rate beyond such traffic center to or from the commuter's place of business as one continuous journey to be at the regular zone rate.

School Tickets. To be issued at the rate of 1 cent per zone, not fewer than three tickets for three zones or less and one ticket for each additional zone. Other conditions relative to school tickets to remain the same as at present established by the company.

Transfers. Free directional transfers shall be issued: (1) On cash fare, entitling the passenger to ride through two zones for the initial cash fare of 6 cents without additional charge and the regular cash fare for each additional zone. If the cash fare passenger has ridden through two or more zones before transferring, he shall be entitled to a transfer entitling him to ride through the next zone or zones at the regular rate of 3 cents each. (2) On zone tickets entitling the passenger to ride through three zones for the initial fare of three tickets without additional charge and the regular ticket fare for each additional zone. If such passenger has ridden through three or more zones before transferring he shall be entitled to a transfer, allowing him to ride through the next zone or zones at the regular ticket-zone rate.

In no case shall a transfer entitle a passenger to ride through more than two zones on such transfer.

To relieve the shortage of rolling stock likely to be caused by the inability to operate the pay-leave system of fare collection on cross-bench open cars, the commission advocates the use in summer of such open cars for special holiday and peak service only, first on lines not exceeding two zones in length having only the initial fare charge; secondly, when these cars are used for special service on runs exceeding the initial fare, a flat rate may be charged not exceeding the maximum fares under the zone ticket rate for such runs. Transfer privileges may also be eliminated at the discretion of the company when open cars are operated.

The commission asks for full co-operation on the part of the company employees and good will on the part of the public, and states that if at the end of a reasonable period of time it is demonstrated that the rates or system are unfair either to the company or to the traveling public it will, upon proper presentation, unhesitatingly and without prejudice, by reason of anything herein stated or decreed, consider and revise such rates or system in accordance with facts there presented.

New Car Arrives in Seattle

THE sample car ordered for trial by the Seattle Municipal Street Railway has been placed in service. This is a single-end, double-truck, front and center-entrance car for one-man, two-man or multiple-unit train operation. It weighs 34,600 lb. equipped and has a seating capacity of sixty-eight. The equipment consists of four Westinghouse 40-hp. interpole motors, type



TRYING OUT SEATTLE'S NEW CAR

514, with Westinghouse H.L. control. Helical gearing is used, with a gear ratio of 15 to 58. The wheels are 24 in. in diameter and of rolled steel. The airbrake equipment is straight air, with emergency and safety features.

In an attempt to prevent trouble in operation due to unfamiliarity with the equipment special instructions have been issued regarding the handling of the equipment.

Motor Trucks Used for Conveying Freight

A system of conveying l.c.l. freight between different railroad terminals in Cincinnati, by means of motor trucks and containers of 5-tons capacity each, has recently been put in operation in that city by the Motor Terminals Company. In May, 1917, the Cleve'and, Cincinnati, Chicago & St. Louis Railroad made a trial installation of the system, which proved so successful that it has now been extended to the other terminals. The containers are brought to the railroad freight houses by automobile. When they reach there they are lifted by electric hoists and carried close to the freight cars, where they can be loaded at minimum cost. They are returned by mechanical means to the automobile, then carried to destination. A material saving over former methods is claimed.

Philadelphia Fares Analyzed

Reports Give Statistics for Last Nine Years—Deadlock Over Operation of Frankford Elevated Line — New Capital Required

RECENT transportation history in Philadelphia in connection with the proposed lease of the municipally built Frankford Elevated Railway to the Philadelphia Rapid Transit Company is summed up in two reports just issued by William S. Twining, Director of the Department of City Transit, Philadelphia. Various proposals and counter-proposals have been made by the city and the company for the operation of this line by the company, the last proposal of the company, that it pay a nominal rental only for the structure, being withdrawn last November because of opposition to it in the Council.

Construction on the Frankford Elevated Line was begun in 1916 and the city's present investment is shown in the following statement:

FRANKFORD ELEVATED RAILWAY — FIRST OPERATING SECTION

Class of Outlay	Total Estimated Cost	Money Expended by City Cost to March 1, 1920	Per Cent of Present Cost to Final Cost
Real Estate	$600,000	$291,607	48 5
Construction contracts (including tracks)	5,720,660	3,632,841	63.5
Equipment	3,285,000		
Engineering and miscellaneous	600,000	493,615	82 3
Interest	900,000	160,000	17 8
Totals	$11,105,660	$4,578,063	41 0

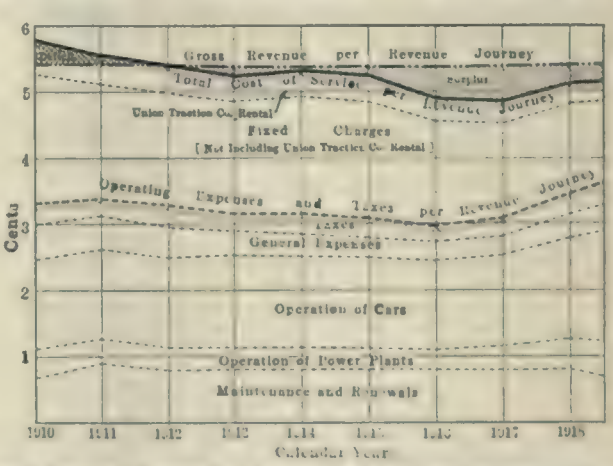
In the opinion of the Director of City Transit much of the difficulty which the railway company now finds in undertaking to carry out the rapid transit proposals of the city lies in the rentals which it has agreed to pay to its sub-companies, which even prevents the furnishing of adequate surface transportation facilities at present.

According to Mr. Twining, the company's management deserves great credit for its "skillful steering between the Scylla of increased fares and Charybdis of bankruptcy," but the limit has now been reached, and to provide the facilities urgently needed either the present fares must be increased or there must be a scaling down of the fixed charges. A diagram is then shown of the cost of transporting a passenger in Philadelphia from 1910 to 1918 inclusive and during the first six months of 1919.

COST OF TRANSPORTING A PASSENGER IN PHILADELPHIA

In commenting on this diagram the Director points out that during the first six months of 1919 the operating cost, including taxes, was 3.62 cents per revenue passenger and the fixed charges 1.5 cents, making the total cost 5.12 cents per revenue passenger. On the other hand, if the company's gross revenue for the period be divided by the number of revenue passengers it will be found to equal 5.39 cents per revenue passenger. The surplus available for dividends, support of new capital, reserve, etc., amounts to only 0.27 cent per revenue passenger, an amount declared by Mr. Twining entirely too small for the purpose. Continuing, he says:

"The mere fact that the cost of service at the present time is over 5 cents per revenue journey shows that on a free transfer basis the flat 5-cent fare would not alone meet the costs of the company. The company's 5-cent fare earnings are now supplemented by the sale of 3-cent exchange tickets, the revenue from freight, express, milk, advertising, etc., and income from other sources. . . . The diagram shows that since 1910 (except in 1916 and 1917) the average cost of carrying revenue passengers has exceeded 5 cents. The diagram also shows that the low point in operating expenses was in 1916, and that there has been a rapid increase in the item of cost per passenger since that time. The fixed charges have dropped from 1.92 cents to 1.50 cents per passenger since 1916, because very little new capital has been employed and because the "fixed charge" on earlier capital is a fixed sum, the aggregate amount of which has not been changed appreciably in recent years. As the number of passengers carried has increased nearly 30 per cent during this period, the fixed charges per passenger have naturally come down proportionately. Had the ratio of fixed passengers to



THIS CHART SHOWS REVENUE AND DISTRIBUTION OF EXPENSES PER REVENUE PASSENGER, PHILADELPHIA

operating expenses remained what it was in 1916 the cost per passenger would now be 5.54 cents and the company would be showing a deficit in place of a surplus."

In conclusion Mr. Twining says that the saving made during the last few years is to be attributed primarily to the minimum investment in new facilities, a course made possible by the "complacency" of the public under "heart-breaking" conditions.

According to the report, facilities required today to render adequate service will approximate $20,000,000 to be put in service immediately, and within the next ten years at least $50,000,000 more should be supplied. About half of the $20,000,000 of facilities needed immediately is represented by the Frankford line and one-half by necessary surface line extensions.

Short-Circuit Tests Prove Interesting

AS A RESULT of short-circuit tests of a 10,000-kva. turbine alternator E. S. Henningsen, of the engineering staff of the General Electric Company, draws some interesting conclusions. These are reported in the March, 1920, issue of the *General Electric Review*. Among other things he says that adding external reactance in a generator circuit equal to the internal reactance of the machine reduces to one-half the instantaneous short-circuit current. At the end of one second, however, the current is practically the same whether the external reactance is connected in or not, if the leakage reactance of the machine is small compared with the synchronous reactance.

Some Mysterious Car Ailments

Little but Important Troubles That Tend to Keep Equipment Men Interested in Their Work

CONTRIBUTIONS ARE INVITED FROM THE FIELD



Is There a Remedy for Carelessness?

ON A LARGE electric railway property operating multiple-unit trains it was the practice to reduce the length of the trains after rush hour by cutting cars off at the terminal, according to the requirements of the service. On one occasion the drill crew, after making the necessary uncoupling, was told to back the car away, so the link could be removed. The car was started, but when the motorman tried to apply his brakes, to his surprise he found that they did not respond. A glance at the air brake gage showed that he had full reservoir and train line pressure, so there was obviously something wrong with the brake apparatus. The motorman then tried to reverse his train by applying power, but this also failed. As the car was on a grade it gained momentum rapidly, so that when the motorman tried to stop the car with hand brakes, these were useless. Seeing a train approaching at the foot of the grade, he realized that disaster was inevitable, and accordingly jumped from the car, leaving it to proceed without an operator. A collision resulted which badly damaged several cars. Fortunately, there were no passengers on the train with which the car collided and the motorman was not badly injured.

The runaway car was examined to determine the cause of the failure of the brakes, and it was found that the triple valve had been cut out. A previous crew had found the car giving trouble, due to the sticking of the "triple" and had cut out the "triple," allowing the train to operate with this one car in this condition. Due to carelessness the defect was not reported and the accident resulted.

Weeding Out Weak Spots in Jumpers

THE breaking of wires in jumpers on roads which employ multiple-unit train operation is a continual source of annoyance and many roads have taken heroic measures to reduce their troubles from this source. The telephone rings in the office of the foreman of inspection and an excited voice yells: "Send an electrician to the incline on the main line and have him bring a new jumper." In such cases the electrician usually does not have to look for the trouble, as the train crew has already located an open circuit in one of the jumpers by the time he reaches the scene.

The mechanical department of one large elevated railway system has succeeded in reducing the number of failures in jumper cables by 75 per cent through a systematic testing, which eliminates all weak cables before they break down in service and an actual open circuit occurs. All jumpers are tested once a month and the back end of the head is painted a new color each time, so that any jumper which may have been missed can be readily picked out and sent in for this periodic test. In making this test a number of jumpers are connected together to form the external circuit and these are connected across the terminals of a 500-amp. storage battery. Sufficient cells are connected in the circuit to secure a current of from 80 to 110 amp. The object of the test is to put enough current through the jumpers so that if there is a wire in one of the circuits which has a few strands broken the remaining strands will be burned out, and thus any partially broken jumpers will be weeded out. Each wire in the jumpers used is equivalent to about a No. 13 wire. Through this process of frequent tests the failures of jumpers on this road have become comparatively rare.

A similar current breakdown test for jumpers in which 50 amp. at 550 volts is passed through the jumper wires in series was described in the ELECTRIC RAILWAY JOURNAL for March 15, 1915, page 487.

Blowing Circuit Breaker Gives No Indication of Location of Trouble

ONE of the cars in city service on a large railway property was reported for "blowing" its circuit breaker day after day and all shop tests failed to locate the trouble. Commutator bar tests were made as well as open-circuit tests, checks on the winding, high-potential tests and resistance tests with a millivoltmeter, but all were of no avail. The connections of the motors were carefully checked and tested, brush-holders inspected and the brush tension adjusted, but still the car continued to give trouble.

The men responsible for the maintenance of the equipment began to get somewhat "peeved" and many felt sure that the motormen were to be blamed for the difficulty. In a final effort to determine the cause, it was decided to have a crew of shopmen take the car over the line and operate it in test service. The covers were removed from the motors to permit inspection during operation. The circuit breaker was given a special adjustment and the tripping mechanism was set up so that the current necessary for tripping it would be increased somewhat. The car operated perfectly for a considerable time when suddenly, while operating at high speed with the control equipment in

full parallel, one of the motors flashed over. Another start was made and again this motor flashed. The part giving the trouble had been located, but still all were in the dark as to its cause. The car was returned to the shop and the motor was opened up and entirely dismantled, but there was no outward sign to indicate the cause of the trouble.

It was then decided to rewind the armature. When the windings were removed it was found that the laminations were bent and the slots forced out of line from their true position, so that the tops of the laminations were out nearly the width of a coil. At some previous time this armature had been rubbing on the pole faces and this damage was the result. The armature was then rebuilt and a new set of windings were installed. It was then put back into the motor and the car returned to service, after which it gave no further trouble.

Auxiliary Devices May Cause Failure of Main Equipment

ONE car on a system operating high speed local service between cities gave trouble by frequently "going dead" without any apparent reason for it. Motormen reported that the control equipment would be inoperative for as many as five or six times on a single trip, but after waiting a short time the equipment would again operate satisfactorily. The car was equipped with the electro-pneumatic switch-group type of control. On several occasions the motorman got out and opened up the switch group in an endeavor to determine the cause, but could find nothing out of the ordinary. The car was turned in at the shop and tested out in the usual manner, also without locating the defect, but in the course of the inspection it was found that one of the switches of the line switch was somewhat sluggish. The line switch consisted of two separate switches connected in series and the inspector decided that the sluggish operation of one of the switches might be the cause for the open circuit.

The wiring and connections were tested for improper contact, but these proved to be satisfactory. The car was then operated by the shopman, who found that after repeated operation he was able to cause the sluggish switch to stay open. The air pressure used for closing the switch was less than the main reservoir pressure, being reduced by a reducing valve. By checking up the air pressure at the time the switch refused to operate it was found that this was low due to the repeated operation. Ordinarily the pressure used for the switch group operation was 70 lb., and it was found that if the pressure dropped to 50 lb. this sluggish switch would not operate. In examining this switch it was found that the spring for opening the switch was somewhat stronger than that in the other switch and a leak in air pressure was also found at some of the valves.

This leak, together with the air used for operating the switch group, kept the pressure from increasing, so that it stayed at 50 lb. for a considerable time. The different parts of the switch were cleaned carefully and oiled and the switch was then found satisfactory and it could be operated at air pressure considerably under 50 lb. By tightening the leaky connections the danger of failure was also lessened considerably and the car operated well in service.

Why Do Commutator Leads Break?

AN INTERURBAN road operating about forty miles of track experienced a great deal of trouble due to armature leads breaking. At first it was thought that the armature cores were loose, but a careful investigation showed that these were in good condition and tight in all cases. The men responsible for the rewinding of the armatures were very careful and produced a fine looking job, so that it was thought the trouble could not lie in that direction. One of the engineers of the company, however, spent considerable time in the armature room watching the method used in rewinding armatures and he found that in order to give a neat appearance to the leads as they were brought down they were being bent quite sharply. While this gave a very neat appearing job when completed, it was evident that the wearing qualities were being sacrificed by this method. The method of bringing these leads down to the commutator was changed somewhat and further investigation showed that there was also considerable vibration of the leads between the end of the armature slots and the points where they were fastened to the commutator. No doubt this vibration was also responsible for some of the broken leads. In order to remedy the condition the space under the leads was filled in with a mixture of powdered asbestos and shellac. This hardened so that after the leads were in place they were held firmly.

Additional support was also provided for the leads where possible by taping two or more leads together. Previous to the change the leads left the coils at the corners and had no support till the commutator was reached. The change consisted of bringing the leads out farther around on the end of the coil, and then by taping them in, the distance to the commutator was shortened considerably. On armatures with leads going in opposite directions this could not be followed to any great extent, but leads going in the same direction were taped together so as to form a support for each other and make a more rigid construction.

These changes effectively did away with the trouble of breaking of the leads.

The *Electric Journal* for February, 1920, gives the following suggestions for preventing broken leads:

The windings should have a solid foundation and should be solidly built up between the top and bottom leads.

Small wire leads should be shellacked back of the neck while winding.

The complete armature should be dipped in a baking varnish and baked.

The laminations of the core should be a tight driving fit on the spider or shaft and should be held tightly together by a ring nut.

The commutator should be clamped under pressure while hot, should be held securely and should make a good press fit on the shaft or spider.

The coil supports should be of rigid construction and securely held from movement.

All armatures should be temporarily banded while hot to pull the windings down solidly. The permanent bands should be made of a good grade of hardened steel wire soldered with pure tin solder. Strips of tin should be placed under the core bands before soldering, to make a more compact band. At the front end the band should be placed out near the commutator neck to hold the windings securely in place at this point.

Excessive currents, such as are produced by too rapid acceleration or through faulty handling of cars, should be avoided.

Overspeeding, whether on the level or down grades, should be avoided.

All detail parts of the armature, as well as the completed armature, should be in balance.

Placing a steel wire band on the bottom leads before connecting the top leads has been tried, with but little success.

The armature bearing should be kept tight in the housings and renewed when worn to the allowable limit.

The bearing housings should be kept tight in the motor frame.

The axle bearings should be kept tight in their seats and removed when worn.

The axle cap bolts should be kept drawn up tightly and defective caps should be removed.

The gear case bolts should be kept tight and broken gear cases replaced.

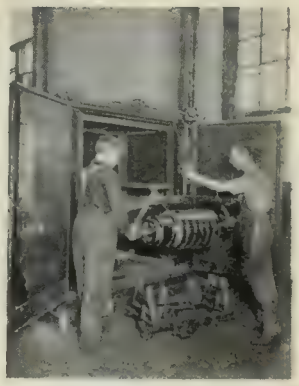
Gears and pinions when badly worn, out of mesh or bottoming should be replaced by new ones, preferably of the helical type.

Tracks, special work and roadbed should be kept in good condition.



Shop, Track, Power and Line

These Articles and Ideas Are From Men on the Job Who Find Special Applications and New Methods an Incentive for Greater Effort — If You Have Something Good Pass It Along



Pacific Electric Opens New Shop

Thirteen Buildings, Covering More Than Nine Acres, Have Been Placed in Service for Maintenance and Building of Electric Cars

BY CLIFFORD A. ELLIOTT
Cost Engineer, Maintenance of Way Department, Pacific Electric Railway, Los Angeles, Cal.

THE accompanying view of the new Torrance shop of the Pacific Electric Railway, which was taken from an aeroplane, shows in a very striking manner the large accommodations provided and the splendid construction of the buildings for their work. The plans and proposed construction of these shops were described in the issue of the ELECTRIC RAILWAY JOURNAL for July 21, 1917, page 95. To provide for future expansion, grounds have been acquired with an area of 125 acres.

Referring to the accompanying view, the building in the immediate foreground is the mechanical department office. Directly behind this is the store department building, and the small building to the right of this is an oil storehouse. The three large buildings which constitute the central group from left to right are the woodwork and paint shop, the electrical repair shop and the electrical winding and machine shop, respectively. The small building on the right, which in the view appears like an addition to the large shop, but which is in reality a separate building, is the blacksmith shop and forge room. The small addition to the paint shop, on the extreme left, is used for paint storage and mixing. In the rear of the central large building are the power plant, cornice works, welding rooms and other workshops. A total of thirteen new shop buildings have been erected. These are of steel-frame construction with concrete foundations, brick and concrete walls and concrete-slab roofs. Special attention has been given to the number and location of the windows so as to provide the maximum amount of evenly distributed daylight.

SOME INTERESTING DETAILS OF CONSTRUCTION

In the motor shop and heavy machine shop the floors are made of 4-in. x 6-in. redwood blocks laid on sand cushion. These blocks were previously treated by boiling in asphalt. The principal machines now in use in these shops were moved from the general shops at Los Angeles, but some additional tools, together with cranes, hoists, etc., have been installed.

In the paint shop steam coils have been located in



AEROPLANE VIEW OF THE PACIFIC ELECTRIC RAILWAY'S TORRANCE SHOPS

each pit for drying freshly painted equipment. It is expected that this will result in a considerable saving in the time necessary for drying the paint. The lamps in the inspection pits are installed in niches and are staggered 21 ft. center to center. Two lighting receptacles are installed in each niche; one contains the lamp and the other is used for emergency purposes so that an extension cord can be inserted and a drop line used where light at the work is needed. An Otis 5-ton self-operated electric freight elevator is installed in the wood mill and a similar type of 2-ton capacity is used in the storehouse. The top floor of the storehouse is used for motor parts and miscellaneous electrical supplies. All air brakes, switch groups and control material are located on this floor. The material cases for small parts on this floor are 6 ft. high and of an open type, so that each bulkhead can be clearly seen without the use of step ladders or boxes. The main floor is used for storing both hardware and miscellaneous supplies. In addition to these two stories the storehouse also contains a basement, where material used in the electrical department is kept.

The oil storehouse previously referred to is located adjacent to the main storehouse and has large steel oil storage tanks in the basement. These are connected with Bowser oil pumps for drawing the oil for distribution at the new shops.

One section of the power house is used for the substation equipment necessary to take care of the local car shops and freight car movement. A 1,000-ft. motor-driven air compressor and a 150-hp., 2,200-volt, three-phase alternating-current motor are installed in this section. A 750-gal. capacity motor-driven air pump for operating the fire equipment is also installed in the power house. This will be relieved by an auxiliary 500-gal. capacity Duplex steam-driven fire pump. Fuel for the power house is supplied from two 8,500-gal. concrete underground fuel oil storage tanks.

New Drill Steel Sharpener

A NEW compressed air operated drill steel sharpener machine, known as the I-R No. 50 Sharpener, has been developed by the Ingersoll-Rand Company, New York. This machine was designed primarily to rapidly and exactly sharpen and shank drill steel such as cruciform steel up to 2 in. in diameter or round, hexagon, octagon, quarter-octagon, auger or spiral steel up to 1¾ in. in diameter. When fitted with special devices it will forge bolt heads, pins, stanchions, etc., and nearly 200 different products have been made by this machine.

The single lever, which controls all of the operations of the machine, is fitted with a safety-locking device. This prevents accidents due to the impossibility of operating the machine unless the lock is released. The throttle valve is of the balance spool type. The hammer cylinder is an improved valveless type. This construction permits the free-moving hammer to deliver fast and powerful blows against the end of the dolly, upsetting the steel and so forming the bits and shanks rapidly, which greatly increases the capacity of the machine.

Positive lubrication is provided for the entire machine by the "Heartbeat" lubricator. This is embodied in the throttle valve chest casting and works automatically whenever the machine is in action. It is provided with adjustment for regulating the quantity of oil desired. All parts are made for hard service and all cup leathers have been eliminated from the design.

Oscillating Motor Crossing Flagman

New Design Has No Gears or Toggles and Swings Through Any Arc in Any Quadrant Without Vibration

A NEW automatic flagman or crossing signal which differs widely in many respects from any similar device formerly available has been placed on the market by the Thompson Signal Company, Los Angeles, Cal. It comprises a 26-in. disk fastened to an arm or arrow 46 in. long having a red light mounted in the end opposite from the disk, the whole oscillating, not as a pendulum but pivoting about its center of gravity. The driving mechanism is a four-pole direct current motor which for steam-road service operates on a 10-volt circuit supplied by primary cells. Where other voltages are available, as in electric railway service, the motor can be wound for the trolley voltage. The disk and arm are mounted directly on the armature shaft, thus avoiding any gearing. The motor is of the external armature type and is made up of eight field coils and twenty-two armature coils which have windings about four times heavier than necessary in order that heating and danger of burnout may be minimized. These coils are so connected in the armature that one or more could burn out without affecting the operation except proportionately to weaken the torque. During a test run of 2,500 hours' continuous operation the temperature rise in the motor was only 10 deg.



INSTALLATION OF AUTOMATIC CROSSING FLAGMAN WITH BELL AUXILIARY

The oscillating movement of the armature and signal is secured by reversing the direction of current. This change in direction of current flow is secured through two fingers mounted on the armature shaft which have a steel roller mounted at their outer ends. As the armature revolves these fingers come into mechanical contact with two switches, producing a cam action, which first closes the switch on one side of the shaft and then that on the other, these two switches alternately closing a circuit through two pairs of magnet coils, which in turn throw the main motor switch first in one direction and then in the other. The fingers of this main switch are laminated and as they are pulled into contact the laminations spread, giving a wiping contact, which tends to keep the surfaces clean.

The driving motor is made in two types, one with a commutator and one without. With the type having a commutator the two fingers which operate the control switches may be shifted relative to each other, so that the armature and signal may be made to oscillate through any arc from 10 deg. to 360 deg., or to rotate continuously in either direction, and further, so that the signal will oscillate in any quadrant.

In the commutatorless type of motor connection to the armature coils is made by means of two spiral-coiled spring-brass leads, which act like the hair-spring in a watch, though not supplying any spring force, the springs merely being used to provide flexible contacts which will avoid brushes and rings and at the same time provide a practically non-breakable connection. On this motor the two fingers operating the control switches are usually permanently fastened together, so that the arc through which the disk oscillates is fixed. However, the quadrant in which the disk will oscillate can be changed if desired, to avoid an obstruction obscuring a clear view of the disk from a distance, by shifting the fingers radially on the shaft.

One of the principal claims for this new device is that there are no springs or rubber buffers employed to reverse the motion. The stopping of rotation in one direction and starting back in the other is accomplished simply by the magnetic cushion as the direction of the field is changed, thus avoiding any vibration and causing the motion of the disk to be very similar to that of a free swinging pendulum, slightly damped at each end of swing. The signal is so weighted that it is slightly out of balance in order that it will assume a normal position when it stops. This provision is made only for the sake of appearance, since the signal will begin its oscillation from any position, the torque being practically constant at all times.

The red light in the end of the signal arm which provides the night warning is connected with fixed connections in multiple with the armature circuit. With the armature type motor there are four flashes of the light during each oscillation, but with the commutatorless type motor the light is steady except for a slight flash as the polarity changes at the end of the oscillation.

New Type of Thermal Demand Meter

THE Westinghouse Electric & Manufacturing Company is now marketing a new type of demand meter employing the principle of thermal storage and indicating what has been termed the "logarithmic average demand." This line of instruments comprises indicating watt demand meters for alternating-current circuits and ampere demand meters for alternating and direct-current circuits.



THERMAL DEMAND METER

The moving element of the instrument consists of a shaft connected to two bimetallic spiral springs. These springs are attached to the shaft at their inner ends and to the cylindrical case at their outer ends and are wound in opposite directions. Thus an equal change of temperature of both springs does not produce any rotation of the shaft. However, if one spring is raised to a higher temperature than the other, it will deflect through a greater angle and the shaft will move through an angle proportional to the difference in temperature of the two springs. The cylindrical case contains a heating element which is connected in the electric circuit and is located in the case in such a way that one spiral spring is raised to a higher temperature than the other. This results in the shaft deflecting through an angle proportional to the load on the meter.

The wattmeter has two pointers, one of which, the indicating pointer, is fixed to the shaft, while the other, the maximum-demand pointer, is free to remain in the maximum position in which it is placed by the indicating pointer. By observing the indicating pointer, the logarithmic demand for the period immediately preceding the instant of observation can be determined. The maximum demand pointer can be reset at any time without removing the cover from the instrument.

The subject of thermal storage demand meters was featured in detail in the October, 1915, and February, 1918, issues of the Proceedings of the American Institute of Electrical Engineers.

Powdered Coal Plant with Compressed Air Transport

Some Details of the System That Will Be Applied in the Mount Vernon Street Plant of the P. R. T.

DURING the present spring the Philadelphia Rapid Transit Company will install in its Mount Vernon Street power plant an equipment for pulverizing and burning waste coal. Some details of the plan were given in the issue of this paper for Feb. 14, 1920, page 343. As the Quigley system, which is to be used in this plant, differs from other systems in several particulars, the accompanying illustration has been prepared to show the several parts of the system and how they are related. The drawing is merely a diagrammatic sketch, designed to show the general plan, but not in detail as it will be applied in Philadelphia. An account of the installation there will be given in due course.

The several parts of the apparatus have been lettered and the key which accompanies the illustration renders it practically self-explanatory. Briefly, the fuel is dumped from the car located on the siding, and, after passing through a crusher, where it is properly sized, it is elevated to a magnetic separator, where the tramp iron is removed. It then passes to the crushed fuel bin, from which it is automatically fed to a rotary drier and is then carried by a bucket elevator to the dry-fuel bin. From this bin it feeds automatically to the pulverizer, from which it is carried through a discharge pipe and a collector into the pulverized-fuel bin.

The pulverized fuel is fed from this bin into the blowing tank in the desired quantities, a quick-reading scale dial indicating at all times the amount of fuel in the tank. The fuel is thus automatically weighed and the amount required to fill the bins at the furnace is forced by compressed air through the transport line. Switching valves divert the flow of fuel to each bin as desired. The fuel supplied to each burner is governed by a controller, regulated by means of a hand wheel. Combustion air is controlled by a blast gate.

The transport system in this equipment differs essentially from the screw-conveyor and high-pressure blast systems in that the fuel is transported in bulk from the pulverizing plant through small wrought or steel pipe without the use of return piping. It is not carried in

suspension, but its movement is analogous to the flow of a liquid. The fuel pulverizing plant may be located at the point most convenient for the fuel supply and the powdered fuel can be economically distributed to furnace hoppers at widely separated points. Delivery has been effected by this method for distances exceeding 1,500 ft. The Quigley Furnace Specialties Company has a record of 2,800 lb. of pulverized fuel having been carried 600 ft. through a 4-in. pipe in one minute under air pressure averaging 15 lb. gage.

From the furnace bins the fuel passes through a dust-tight gate into an especially designed fuel feed controller, which regulates the fuel feed into a low pressure siphon. This siphon carries it, with about one-seventh of the air necessary for combustion, into the burner, where it is mixed at very low pressure with the quantity of air necessary to effect proper combustion.

A feature of interest is the blowing-tank unit, which consists of special equipment for storing, feeding and weighing the powdered fuel and transporting it to the points of consumption.

The tank is of cylindrical steel construction, and it is connected with the pulverized-fuel bin by means of a flexible connection. A control gate located immediately below the bin is now operated from the floor by means of a hand chain.

A valve in the head of the tank admits the pulverized fuel in any quantity desired and is operated by a conveniently placed lever. As mentioned before, the scale upon which the tank is mounted is provided with a quick-reading dial. When the desired amount of fuel has been let into the tank, the charging valve is closed, compressed air is admitted and a shut-off valve on the transport line is opened, after which the fuel begins to flow through the line.

The controller consists primarily of a cast-iron box containing a feed screw, driven at constant speed by a gear or pulley, and adjustable shutters operated by a handwheel which give a suitable opening, under control, leading to the discharge head. The primary air supply at low pressure carries the fuel from the discharge head to the burner, where it mingles with the combustion air, also at low pressure and under separate control. The proper relative supply of each can thus be accurately controlled so that any condition of flame desired may be secured.

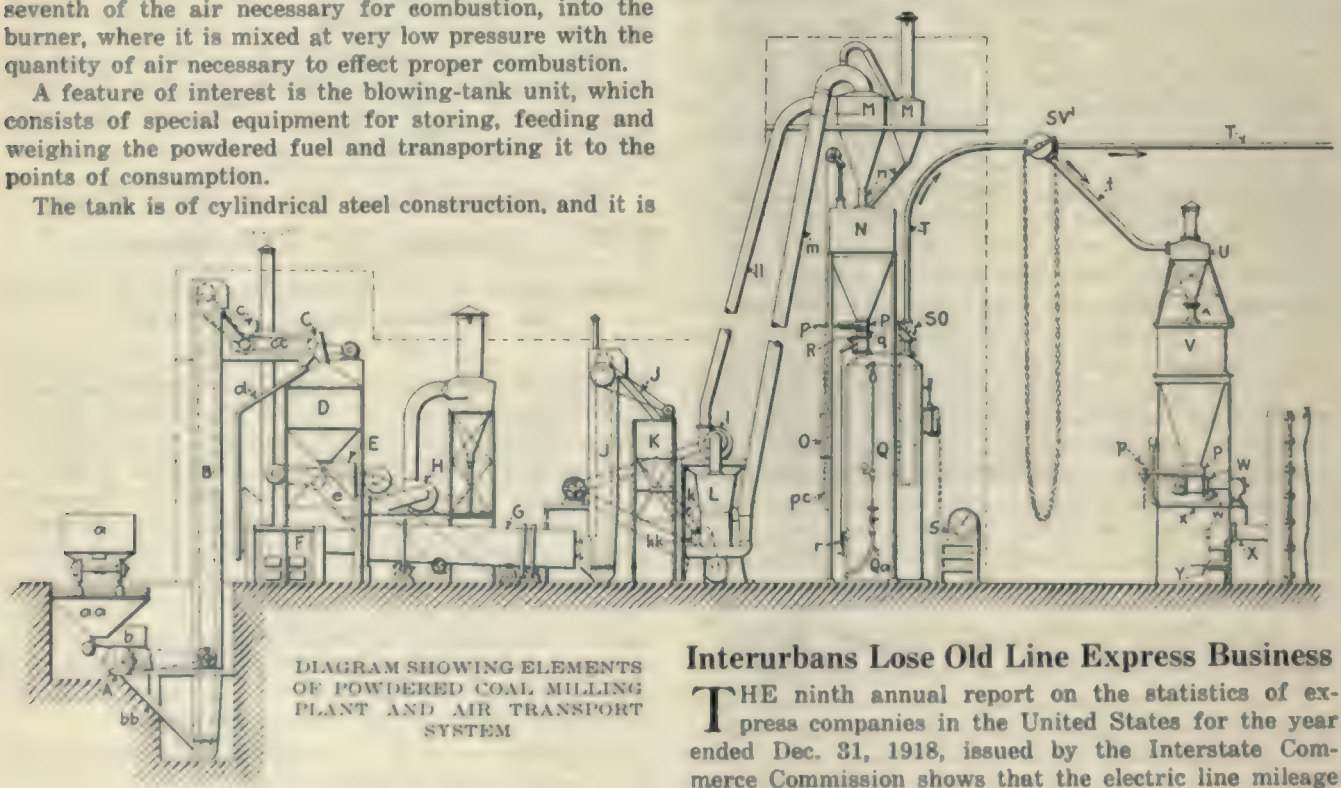


DIAGRAM SHOWING ELEMENTS OF POWDERED COAL MILLING PLANT AND AIR TRANSPORT SYSTEM

KEY TO LETTERS ON DIAGRAM

a	Coal car	m	Return air pipe
aa	Track hopper	N	Pulverized fuel bin
b	Regulating feeder	O	Fuel bin gage indicator
A	Coal crusher	P	Dust-tight gate
bb	Chute	p	Hand chain-wheel
B	Elevator	pc	Hand chain
c	Hopper	Q	Blowing tank
cc	Conveyor	Qa	Compressed air supply
C	Magnetic separator	q	Flexible connection
d	Reject pipe	R	Inlet valve
D	Crushed fuel bin	S	Scale dial
E	Regulating feeder	SO	Shut-off valve
e	Chute	SV	Switching valves
F	Drier furnace	T	Transport line
G	Drier	r	Branch fuel line
H	Exhauster	U	Collector
J	Elevator	V	Furnace bins
K	Dried coal bin	W	Fuel feed controller
kk	Rotary feeder	w	Fuel regulating wheel
L	Pulverizer	X	Burner
l	Exhauster	x	Primary air pipe to burner
ll	Discharge pipe	Y	Combustion air-blast gate
M	Collector		

Interurbans Lose Old Line Express Business

THE ninth annual report on the statistics of express companies in the United States for the year ended Dec. 31, 1918, issued by the Interstate Commerce Commission shows that the electric line mileage covered by operations had decreased from 8,802 on Dec. 31; 1917, to 6,951 a year later. This is equivalent to a loss of 21 per cent. The accompanying table gives the mileage under contract by each of the operating express companies.

CLASSIFICATION OF MILEAGE COVERED BY OPERATIONS ON ELECTRIC LINES

Carrier	Electric Line Mileage 12 31 1918	6 30 1918	12 31 17	Per Cent of Total Mileage of Operations 12 31 1918	6 30 1918	12 31 18
Total mileage of operations	6,951	8,690	8,802	2 42	2 81	2 86
American Railway Express Company	6,951			2 42		
Adams Express Company		2,637	2,739		5 45	5 63
American Express Company		1,064	1,064		1 45	1 45
Canadian Express Company		113	113		0 91	0 91
Great Northern Express Company		335	335		3 69	3 68
Northern Express Company		14	14		0 17	0 17
Southern Express Company		77	77		0 22	0 22
Wells Fargo Express Company		4,422	4,431		3 73	3 83
Western Express Company		28	28		0 53	0 53

The fortieth anniversary of the piercing of the Gothard tunnel between Switzerland and Italy was celebrated on Feb. 27. This important artery of travel is now doubly interesting because it is in process of electrification.

Forms Used with Sand Drier Test

For Tabulating the Data Obtained in Tests of This Nature Conveniently Arranged Forms Are Essential

THERE was published in the March 20 issue of the ELECTRIC RAILWAY JOURNAL a description by Howard H. George of the wet sand-handling machinery installed at the sand-drying plant of the Public Service Railway at Newark, N. J. In this article reference was made to forms which were used in the tabulation of the data secured from long-period efficiency tests of the plant both before and after the installation of the wet sand hopper. As other railways operating similar plants may desire to run tests of their own equipment, these forms are now published with some additional data and descriptive matter.

In computing the total labor cost of operating the plant the salary of the engineer running the tests was not included. In gaging the bins and for the purpose of aiding the laborers in quickly leveling the sand in the bins with a reasonable degree of accuracy the walls of the bins were carefully marked with level lines spaced at convenient intervals and three gage rods graduated to tenths of feet were installed at convenient points for interpolation. With the cross-section of the bins once determined, the calculation of the amount of sand in the bins at any time was easy.

The same procedure applies to the measuring of sand removed in bags. A large number of bags were dumped into a smaller measuring box until it was filled, and the average quantity per bag thus obtained was used in determining the total amount of dry sand distributed in bags.

The record of the temperature and weather conditions was made because of their effect on the percentage of moisture in the sand coming to the drier from the storage pile, the resulting increase or decrease in the output of the plant in a given time and the effect of this on the coal consumption.

Repairs were also noted, because they are always a factor that must be taken into consideration in the total cost of production in any plant. It may be argued that in tests of such a comparatively short duration as those described the amount of repairs will be so small as to be of little value. As a matter of fact, in this particular test it was found that they bore practically the same relation to the output as was generally true for the general operation of the plant, the repairs being limited to a replacement of a conveyor belt, broken link transmission chain, worn agitator blade or something of that character.

Form 1

RECORD OF SAND DRIER TEST

DATE _____

TEMPERATURE AT 7-A.M. _____
TEMPERATURE AT 12- M. _____
TEMPERATURE AT 5-P.M. _____

WEATHER _____

LABOR

CLASSIFICATION	HOURS	RATE	AMOUNT
SHOVELERS			
FIREMEN			
SAND BAGGERS			
TOTAL COST OF LABOR			

QUANTITIES OF DRY SAND

GAGE READINGS IN BINS AT BEGINNING OF DAY..... GAGE NO. 1 _____
GAGE NO. 2 _____
GAGE NO. 3 _____
GAGE READINGS IN BINS AT END OF DAY..... GAGE NO. 1 _____
GAGE NO. 2 _____
GAGE NO. 3 _____

NUMBER OF BAGS FILLED WITH SAND DURING DAY _____
NUMBER OF CUBIC YARDS OF SAND BAGGED DURING DAY _____

NUMBER OF CUBIC YARDS OF SAND REMOVED IN CARS

TIME	CAR NUMBERS	CAR MEASUREMENTS	CUBIC YARDS IN LOAD

TOTAL DRY SAND REMOVED IN CARS _____
TOTAL CUBIC YARDS SAND DRIED DURING DAY _____

Form 2

COAL

NUMBER OF POUNDS OF COAL USED DURING DAY _____
CHARGE PER TON OF 2240 POUNDS _____
TOTAL COST OF COAL FOR DAY _____

OIL

AMOUNT OF OIL USED DURING DAY _____
UNIT COST OF OIL _____
TOTAL COST OF OIL FOR DAY _____

WASTE

WASTE USED DURING DAY _____
UNIT COST OF WASTE _____
TOTAL COST OF WASTE _____

POWER

WATTMETER READING AT END OF DAY _____
WATTMETER READING AT BEGINNING OF DAY _____
POWER CONSUMED DURING DAY _____
RATE PER KILOWATT HOUR _____
TOTAL COST OF POWER _____

REPAIRS

(MEMORANDUM IS TO BE MADE OF ALL MATERIALS AND LABOR USED IN MAKING REPAIRS, TOGETHER WITH TIME LOST ON ACCOUNT OF SAME.)

MISCELLANEOUS MATERIALS

Form 3

PERCENTAGE OF MOISTURE

SAMPLE TAKEN AT	WEIGHT OF MOIST SAND	WEIGHT AFTER DRYING	LOSS IN WEIGHT	PERCENTAGE OF MOISTURE
7-A.M.				
8-A.M.				
9-A.M.				
10-A.M.				
11-A.M.				
12-M.				
1-P.M.				
2-P.M.				
3-P.M.				
4-P.M.				
5-P.M.				
TOTALS				
AVERAGE:				

MISCELLANEOUS REMARKS

(Under this heading note any occurrences which might in any way affect the results of the test.)

RECORD FORMS USED IN CARRYING OUT SAND DRYING TEST

Several months ago the Indianapolis Street Railway sent ten of its summer cars to Dayton, Ohio, to be converted to the pay-as-you-enter type. Five of these have been returned for service. In remodeling the cars special attention has been given to providing a large platform space, to prevent crowding and to reduce the time required for boarding and alighting.

Chicago's First Trail Car Under Way

One Only to Be Built Now for Trial Purposes to Determine Feasibility from Traffic and Equipment Standpoints

CHICAGO will probably go to the use of trailers as the quickest and most logical way of amplifying its rolling stock facilities. As the first step in this probable plan, a sample trailer is being built in the west side shops of the Chicago Surface Lines, and Harry H. Adams, superintendent of shops and equipment, is making a drive to build this first car within sixty days' time, two weeks of which has elapsed at the time of this writing, with the progress made pictured herewith.

The use of trailers seems particularly desirable from the standpoint of facilitating the movement of cars through the congested loop district, for it is believed that a two-car train will lose less time in the loop than two single cars. As soon as this first car is completed thorough trials will be made to determine this point as well as to find out whether the public will like the idea of trailers and whether trailer operation is adaptable to Chicago traffic conditions. Observations will also



A TWO WEEKS' PROGRESS PICTURE OF CHICAGO'S NEW TRAILER

be made on the heating of the motors on the Pullman cars, which are proposed for use in hauling the trailers, both in rush-hour service only and for all-day service. The Pullman cars are equipped with four G.E.-216, 55-hp. motors, and while it is felt certain that they will haul trailers during the rush hour without serious overheating, there is some question about the all-day service. The trailer is to be a center-entrance car with an over-all length of 47 ft. 6 in., a width of 8 ft. 6 in. and an over-all height from rail to top of roof of 10 ft. 9½ in. Every effort is being made to produce a car which will weigh not more than 24,000 lb., although this may be influenced to a certain extent through the use of materials at hand that are slightly heavier than desired, for the sake of avoiding any delay in waiting for delivery of new materials.

There will be a 6 ft. 6 in. opening at the center on either side of the car, with pneumatically operated doors sliding into pockets—two doors on each side, requiring four door engines. There will be a level well 15½ in. above the rail, then a step of 10½ in. from the well to the car floor with a ramp of 5 in. in 9 ft. toward each bolster.

The body will be of arch-roof construction with a steel underframe and No. 12 gage steel side plates and a wood superstructure. The bumpers will be brought up to the average height of the motor cars and automatic air couplers installed, one on either end. Ample ventilation will be provided by the installation of eight utility exhaust ventilators in the roof and two compensating air intake and exhaust ventilators in each end of the car. At the forward end the two ventilators will act as intakes, while the two at the rear will act as exhaust ventilators.

There will be twenty cross seats of the walkover form-fit design, with rattan covering, and four short longitudinal seats at the well. These, with the circular seats at the two ends, will bring the total seating capacity up to sixty-two passengers.

The car will be equipped with Brill 67-F trucks mounted on 22-in. rolled-steel wheels, with a wheelbase of 4 ft. 4 in. These trucks have cast-steel side plates and a single coil spring over the journal box in addition to the long elliptic springs in the bolster.

For hauling the sample trailer, one of the Pullman cars will be equipped with double-folding, pneumatically operated doors on the rear platform, and probably some rearrangement of the car interior looking toward an increase in the number of seats from 40 to 48 or more will be made. The abandonment of smoking on the front platforms has made it possible to take out the bulkheads and this may be done in connection with the reconstruction for trailer service. The details of the Pullman alterations have not as yet been definitely decided upon. This would indicate that the trailer plan of operation in Chicago, if adopted, will include a reconstruction in some respects of all the Pullman cars. How many motor cars will be thus reconstructed and how many trailers will be purchased and built in the company's shops are as yet open questions.

Cattle Guard for Automobiles

SINCE the beginning of operation of the Municipal Railway through the Twin Peaks Tunnel in San Francisco there have been several instances of automobiles being driven through this tunnel, which is strictly a railway tunnel and is not paved.

In one instance the driver of the machine entered the tunnel at the west end and upon arriving at the Laguna Honda Station, about a half mile from the portal, he succeeded in turning his machine around over the car rails and went back through the tunnel, while one of the lady passengers jumped from the automobile, due to fright from an approaching street car, leaving her hat in the automobile. This lady was seen several hours later by the elevator operator in the tunnel still searching for her party and her hat. In three other instances which were reported to the superintendent of the Municipal Railway the persons in the machines went entirely through the tunnel.

To overcome this danger a concrete pit or cattle guard has been constructed under the car tracks at the entrance at each end of the tunnel. This pit is about 4 ft. wide and 2 ft. deep and will effectually prevent anybody in the future from driving an automobile through the tunnel.

Since 1911 the number of persons transported per accident by the Philadelphia Rapid Transit Company has increased from 18,640 to 50,043, equivalent to a gain in "safety efficiency" of 18.8 per cent per year.

New Alloy for Railway Use

Aluminum Castings That Are Claimed to Have the Strength of Mild Steel Offer Possibilities for Weight Reduction

A NEW alloy, known as Duralumin, having properties which will be of great interest to railway men in connection with their efforts to reduce the weight of rolling stock, has been developed by the Aluminum Company of America. Having the unique combination of the lightness of aluminum with the strength of mild steel, the significance of its application to rolling stock will at once be appreciated. The physical properties of the metal are as follows:

Tensile strength, depending on the amount of cold working and proper heat treatment	50,000 to 60,000 lb. per square inch
Elongation in 2 in.	15% to 20%
Brinell hardness, using 10-mm. diameter ball at 500-kg. pressure	85 to 100
Shore hardness magnifying hammer	30 to 45
Specific gravity	2.8 to 2.85
Weight	0.1 to 0.102 lb. per cubic inch
Melting point	650 deg. C.
Coefficient of linear expansion	0.0000226 per deg. C.
Young's modulus	4700 tons per square inch
Thermal conductivity (silver 100)	31

In addition to these very desirable physical properties Duralumin is claimed to be fully as resistant to corrosion as is pure aluminum.

The above values for tensile strength, elongation, elastic limit and modulus of elasticity are obtained through the combination of mechanical work put upon the metal and heat treatment and are, therefore, obtainable only in the wrought forms. They do not hold true for the cast metal.

The Aluminum Company has been engaged for about a year in experimental work looking toward the development of methods of manufacture of Duralumin on a commercial scale. The technique of sheet rolling has been established in an experimental mill, the capacity of which is, of course, limited. However, the company reports that the sheet-rolling capacity for this alloy probably will be large enough by the end of the current year to take care of any reasonable demand.

The problems of the commercial fabrication of bar, rod and tubing from this alloy are not yet solved, and it is probable that these shapes will not be put on the market for another six months at the very earliest. The fabrication of this alloy is slow and costly and a very special technique for handling had to be developed for every stage in the process. However, the prospects for the production and the use of this alloy are very promising and the manufacturer is developing it, having in mind its wide application to electric railway rolling stock construction.

The numerous small brass castings which are used on a car, when taken together, represent considerable weight. The development of light aluminum alloys offers a chance to reduce this weight.

The Aluminum Manufactures, Inc., Cleveland, Ohio, have developed aluminum alloy castings having a tensile strength of 27,500 lb. per square inch and an elongation of 4.5 per cent, yet weighing only four-tenths as much as cast iron.

Thus far, these aluminum alloys have been used almost exclusively in the automobile industry, the manufacturers having gone so far as to make rear axle housings for 5-ton trucks of this material. In this connection it is said that while the aluminum alloy casting is not as strong, section for section, as the malleable iron or steel casting usually employed for this purpose, yet by a slight increase of the section it is possible to secure a strength equal to that of the ferrous housing and still have a weight only one-half as great.

Mutilating the Fiber of Wood Ties

The accompanying illustration shows a section of a white cedar tie split open after having a common wedge point spike and a goldie spike driven into it. The mutilation of the fiber of the wood by the common wedge point spike, which is shown at the right in the illustration, is quite pronounced.



SECTION OF TIE WITH DRIVEN SPIKES

Ratchet Jacks Improved

THE Buda Company has recently developed some new jacks which have been designed for heavy duty. Two new double-acting trip track jacks, Nos. 201-B and 206-B, are improvements over the Nos. 1-B and 6-B jacks, and the No. 219-B single-acting automatic lowering car jack is an improvement over the No. 19-B jack. These have been strengthened by ribbing the frame and base, and the additional metal has been distributed in such a manner as not to increase the weight of the jack. An improvement which will tend to make the jacks practically indestructible, it is claimed, is the use of hardened steel inserts for pawl bearings for the socket levers and the use of high carbon spring steel fulcrum pins which are machined, tempered and ground.

Chilled Wheels in Europe

THE Secretary of the International Street Interurban Railway Association has issued a bulletin saying that it had received from one of its members the following letter:

> On account of the high price of steel wheels and the difficulty of obtaining them during the war, we have tried for our cars chilled iron wheels purchased in America. We believe the results obtained by them so interesting as to communicate it to you.
>
> One of our motor cars equipped on June 15, 1919, with chilled wheels had run up to Dec. 3, 1919, 16,814 km., and the wheels showed very little signs of wear. A second motor car was equipped on Nov. 15, 1919.
>
> A number of trail cars have been equipped for a long time with these chilled wheels, and some of them have covered as much as 85,000 km. The wheels of these cars are apparently good for much additional mileage, the wear, in wheel diameter, being about 4 mm. One of these wheels having made 94,000 km. has been retired from service, because it developed a flat, probably on account of a fault in the casting. This wheel has been sent to the cupola and has given as good results as pig for recasting.
>
> Up to the present we believe that the mileage service of cast wheels is not inferior to that obtained with steel tired wheels.

In view of this communication, the association is collecting information from its members as to the service records of wheels.

Association News

Data Sheet for Life of Wearing Parts of Lubricated Motors

SECRETARY E. B. Burritt, on behalf of the committee on equipment of the Engineering Association, has sent to representative companies data sheets to be filled in with information on the life obtained from armature bearings, axle bearings, gears, pinions and carbon brushes. The list includes twenty-six questions regarding the life and service conditions for these parts, and the committee hopes to secure information which when compiled will be of valuable assistance to the various member companies and equipment manufacturers.

Fare Collection Committee Meets

ON March 29, 1920, the first conference of the joint committee on collection and registration of fares was held at association headquarters, in New York, to organize and plan the work for the year. Those in attendance were: W. J. Harvie, Auburn, N. Y., and M. W. Glover, Pittsburgh, co-chairmen; J. J. Duck, Chicago; L. D. Pellissier, Holyoke; E. C. Spring, Allentown; R. A. Stevenson, representing I. A. May, New Haven; C. W. Stocks, New York, and F. E. Webster, Haverhill, Mass.

The committee believed that inasmuch as its report of last year covered in full the matter of collecting flat fares this subject should not be opened up again this year, but that its efforts should be confined to the question of collecting zone fares on urban and suburban lines. An outline for its report along these lines was consequently developed, together with a questionnaire to be answered by all members. Companies are urged upon the receipt of this request for information to give the matter prompt attention, so that the work of the committee will not be delayed to such an extent that a full report cannot be presented to the coming conventions.

Company Membership

THE personnel of the American Association committee on company membership has been increased to permit the carrying out of the plans outlined in the issue of this paper for April 10, 1920.

The commitee now comprises the following membership: F. R. Coates, Toledo Railways & Light Company, Toledo, Ohio, chairman; E. F. Wickwire, Ohio Brass Company, Mansfield, Ohio, secretary; Benjamin Adams, St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo.; J. P. Barnes, Schenectady (N.Y.) Railway; L. C. Bradley, Stone & Webster, Houston, Tex.; H. F. Dicke, Utah Light & Traction Company, Salt Lake City; C. R. Ellicott, Westinghouse Air Brake Company, New York, N. Y.; L. E. Gould, Economy Electric Devices Company, Chicago, Ill.; C. A. Hall, Eastern Pennsylvania Railways, Pottsville, Pa.; E. B. Moore, Monongahela Valley Traction Company, Fairmont, W. Va.; H. H. Norris, ELECTRIC RAILWAY JOURNAL, New York, N. Y.; R. T. Sullivan, Tacoma Railway & Power Company, Tacoma, Wash.; E. M. Walker, Terre Haute Traction & Light Company, Terre Haute, Ind., and E. P. Waller, General Electric Company, Schenectady, N. Y.

Information Bureau Reports

RECENT reports and compilations prepared by the Bureau of Information and Service of the American Electric Railway Association appear below. These reports are available to member companies upon request:

Analysis of Agreements on Working Conditions for Trainmen, dated April 1. This abstract covers a number of the larger electric railway properties and includes the following subjects: Parties to contract, arbitration, hours of labor, length and kinds of runs, overtime, extra compensation, minimum wages, methods of choosing runs, working the extra list, Sunday and holiday work, purchase of uniforms, arrangement of reliefs, special work, instructing students, securing time off, etc.

Recent Decisions on Apportionment of Costs Between Electric Railways, Railroads and Public Authorities for Joint Improvements, Changes in Grade, Elimination of Grade Crossings, etc., dated March 13.

Fatal and Total Accidents on Electric Railways, dated March 23, 1920.

Tabulation Showing the Shrinkage in Public Utility Securities During the Years 1914 to 1920, Subdivided Between Electric Railways and Other Public Utilities, and Showing Stocks and Bonds Separately, dated March 15, 1920.

A Supplement to Bulletin No. 123, on Working Conditions, dated Nov. 15, 1919, and bringing this report up to date.

Letter to the Editors

Safety Car Operation in Snowstorms

THE LEVIS COUNTY RAILWAY
LEVIS, QUE., CANADA, April 12, 1920.

To the Editors:

In reference to my article which you published in the issue of the JOURNAL for April 3, page 699, it appears from conversation with several railway men whom I have met that there is an impression that in a snowstorm we pull all our Birney safety cars into the carhouses. This impression is absolutely incorrect and I would appreciate having you take such steps as are necessary to correct it.

In any ordinary snowstorm, with a fall of from 6 to 12 in., the Birney safety cars operate even better than the double-truck cars which we have in use, and further we operate all through the storm. In a blizzard we cannot operate our double-truck four-motor cars; neither can our snow sweepers operate. We are therefore certainly not going to ask the new Birney safety cars to do so. In a blizzard or severe snowstorm, when the sweepers begin to have trouble themselves, we order both the sweepers and the cars into the carhouses, for our sweepers get snowed in just as much as the cars.

If we had the same winter conditions as Quebec, Montreal and other cities, together with good streets, the Birney safety car would operate as well as any four-motor double-truck car, and whenever any of these large cars can operate the Birney cars can.

The photographs reproduced with my article show what the Birneys can do during and immediately after a storm.

H. E. WEYMAN, Manager.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Lively Hearing at Albany

Proposed Service-at-Cost Measure Attacked and Defended—Prospects Not Promising

The hearing at Albany on April 13 on the Jenks service-at-cost street railway measures was attended by delegations from all over the State of New York. The first speech made was that of Mayor Hylan of New York. His remarks with some interpolations were almost identical with the editorial presumably written by Mr. Watson that appeared in the New York *American* on April 13. They well bore out the statement of Job E. Hedges, receiver of the New York Railways, in his opening statement: "The Mayor's remarks are always the same, and always written by the same pen. I have heard them often."

Dire Political Consequences Predicted

In general, legislators were threatened with political oblivion if they voted for any of the measures now pending. President La Guardia of the New York Board of Aldermen attacked the constitutionality of the measures. The corporation counsels of the cities and the representatives who appeared against the bills for New York City all deplored the fact that the measures had been introduced so late in the season without an ample opportunity having been afforded to the people and the corporations interested for their study. They also resented what they termed the attempt by the Legislature to interfere with the home-rule rights of the cities.

The principal persons representing the railway interests were Edward A. Maher, Jr., president of the New York Electric Railway Association; Job E. Hedges, receiver of the New York Railways; William Guthrie for the Brooklyn City Railroad; John D. Milburn for the Nassau Electric Railway, Brooklyn; Adrian H. Larkin, counsel for the Midland Road, Staten Island, and Charles E. Chalmers, receiver of the Second Avenue Railroad, New York.

Mr. Guthrie Opened for Roads

Mr. Guthrie opened the case for the passage of the bills. He confined his remarks strictly to the constitutionality of the proposed measures, quoting decisions of the Court of Appeals of New York and the Supreme Court of the United States to show that the final power to fix franchise conditions and to raise or lower rates of fare is invested in the Legislature of the State. He brought out the point that no municipality could bind the Legislature to a contract forever. He contended that the right conferred upon a Public Service Commission or a Legislature to lower a rate likewise carried with it a responsibility to raise a rate of fare if conditions warranted so doing.

Assemblyman Cuvillier of New York City contended that under the provisions of the rapid transit act as amended in 1912 the Legislature did give to the city of New York the power to enter into contracts for the operation of subways under a partnership agreement and that the Legislature having granted such power is without constitutional authority to pass any law changing the rate of fare so agreed upon by the city of New York as a part of the contract stipulation.

Mr. Hedges argued well for an increased fare for the surface lines of which he is receiver, stating that unless relief be granted some of them will be obliged to close down. Mr. Larkin told of the attempt of the Staten Island railways to obtain relief from the city of New York and the inability of the Public Service Commission to do anything for them under the existing statute. John D. Milburn brought out the fact that under the present arrangement, if nobody wants to agree, the matter can remain unadjusted for years, while the Jenks bills, if an agreement cannot be arrived at within six months' time, the Public Service Commission may compel a change in rate to meet conditions.

It is the consensus of opinion that the bills have little chance of passage. In the first place, they were introduced too late in the session. Had they been introduced earlier in the session it is possible some real solution of the problem might have been reached. It would seem now that the best the traction interests can hope for at this session of the Legislature is the appointment of a committee to study the entire situation in the State of New York and to report to the Legislature of 1921 the result of its findings, together with any suggested legislation to remedy the situation.

Railway Will Contest Detroit Election

Company Will Continue Its Program Unabated, but Will Ask Courts to Establish Its Rights

In a statement by officials of the Detroit (Mich.) United Railway in answer to the inquiry regarding the policy it is intended to follow since the people ratified Mayor Couzens' railway ordinance, they voice their intention to continue to operate the present system as a unified railway at the present rate of fare and with the present system of transfers. It is maintained that now, as before the recent vote, the company stands ready to carry out the terms of the ordinance which it recently made public. It is intended to continue to give all the service that it is possible under the adverse conditions of a shortage in car equipment and men. The company plans to contest the election.

AT THE CLOSE of the construction season the company had under way several important railway extensions under the so-called day-to-day agreement, which it was intended to rush to completion this year. Under present developments, however, the company is not decided as to what course will be followed with this work, since tracks on these streets come within the Mayor's piecemeal plan. In view of the Mayor's statement as to the value of track construction and what he proposes to allow the company for the day-to-day lines, the company officials do not feel justified in spending money for the extensions without some certainty as to the outcome.

The company has a considerable amount of construction work outside of Detroit, not only along interurban lines but in some other cities and towns served. This work will be carried on with all possible speed, and if the labor situation permits efforts that would have otherwise been given in part to construction work in Detroit will be concentrated on the work elsewhere.

Definite action was taken by the company on the Saturday following the election by the filing of two suits in the United States District Court. It is asked that the municipal railway ordinance be declared void and invalid and that the city be enjoined from proceeding under its authority. The company as plaintiff in one suit maintains that the ordinance is invalid in that it contemplates the seizure of part of the company's property without process of law. In the second case, action is brought in behalf of the New York Trust Company, the trustee under a mortgage given by the Detroit, Fort Wayne & Belle Isle Railway. This action is placed on the ground that the taking over of the present Fort Street line as part of the Mayor's municipal program at an estimated cost of $40,000 per mile will jeopardize the value of the property pledged as security for the mortgage held by the trust com-

pany. Mayor Couzens, City Controller Steffens, the three members of the street railway commission and the nine city Councilmen are named as defendants in both cases.

COMPANY APPEALS TO COURT

In the bill filed in behalf of the Detroit United Railway it is stated that the enforcement of the railway ordinance involves the sale of part of the company's property under conditions amounting to coercion, violating the due process clause of the Fourteenth Amendment to the Constitution. The charge is based on the assertions made by the Mayor and written into his campaign literature that the Fort Street and Woodward Avenue lines together with certain day-to-day agreement lines would be taken over at a price estimated at $40,000 per mile. Reconstruction costs of these lines, less depreciation, is set at $87,000 per mile.

It is also claimed that the city has lost its right to order the company to remove its tracks and equipment from Fort Street and Woodward Avenue by allowing the continued operation of these lines by the company since the granting of the ouster decision by the Supreme Court. It is claimed that no resolution or order to remove the tracks was ever passed by the city, but that reconstruction and extension of the Fort Street line had been authorized.

The street railway ordinance is attacked on the ground, it is claimed, that the measure was drawn in such a way as to mislead the voters; that only a portion of the voters were furnished with the sample ballots; that the bond issue authorized is inadequate to carry out all of the provisions of the ordinance, and that the city is bound by the terms of the measure to construct new lines while the actual plan contemplates the purchase of certain Detroit United Railway lines.

Petition for a recount of the ballots in the election was filed by the Detroit United Railway just before the returns were certified by the board of city canvassers. The petition signed by E. J. Burdick, general manager, charges that the ballots were so printed as to permit the inspectors to glance at the votes. The company alleges that the ballots were so thin that voters' marks could be seen, which is contrary to the law providing secret ballots.

In commenting on the company's actions, Mayor Couzens stated that they were indicative of the desperation of the Detroit United Railway in the situation.

CORPORATION COUNSEL CONFIDENT

The throwing out of ballots which the company claims have been exposed will be resisted by the Corporation Counsel. In commenting on the two suits filed by the Detroit United Railway the Corporation Counsel stated that inasmuch as the people have expressed themselves by means of the ballot, he is confident that he will be able to present their side of the question to the court.

A Whole City Walks to Work

Dubuque Cars Have Not Been Operated for Six Weeks—City Seeks to Force Service

Out of the election which was held in Dubuque, Iowa, on April 5 may come a settlement of the difficulty which has made it impossible for the Dubuque Electric Company to operate cars since March 1. It is a strike story with many elements entering into it, among them personal ambition, inborn and cultivated hatred of capital, political cowardice and the failure of the press to realize that it is under any obligation other than the protection of its subscription list. The fight was forced on the company. It could have escaped, perhaps, by sacrificing the property. This it flatly refused to do.

THE PRESENT situation had its beginning in the demand made in March, 1919, by the Amalgamated Association for a wage increase from the then existing base of 34 cents an hour to 50 cents an hour. The company pleaded its inability to pay and preserve its financial integrity.

COMMITTEE INVESTIGATES MATTERS

At the suggestion of the company the City Council in May, 1919, appointed a citizens' committee to investigate the books to ascertain what could be done to meet the situation. This committee reported the inability of the company to increase wages, but further stated that if the company was permitted to charge a 7-cent cash fare with four tickets for 25 cents it could pay a wage based on 42 cents an hour. These figures were found approximately to meet the increased payroll by an equal increase in receipts from traffic. To this arrangement the company agreed, and the fare increase was established by ordinance. The Council also later ordered an audit and appraisal of the accounts and property so as to ascertain whether the employees' wages could be further increased or the new fare reduced. This work was contracted for by the City Council with the C. B. Stiver Company, Des Moines, which called in, by consent of the City Council, the Rau Appraisal Company, Milwaukee, to make the appraisal. The city was to pay the cost of the audit and a certain sum toward the cost of the appraisal. The company was to assume the balance. The work has proceeded since October, 1919. It is expected that it will be completed and submitted to the City Council in a short time.

COMPANY APPEALS AGAINST SPECIAL TICKETS

Previous to September, 1919, there had been in effect during specified hours a fare rate of 2½ cents applicable to "mechanics, working women and working girls." The company regarded this as illegal because of occupational discrimination and these rates were discontinued by the United States Court of Appeals sitting at St. Paul. The trainmen then submitted a demand for a new wage scale based on 60 cents an hour. The company stood upon its agreement to await the completion of the audit and appraisal which was to disclose what change, if any, should be made in the agreed settlement of the previous May.

On Feb. 19, 1920, the company was notified that on March 1 the men would go out if their demand was not granted. The company asked the men to tell the Mayor of their intentions. The Council then appointed a representative committee which proceeded to examine the books and accounts of the company covering a period of three years up to Jan. 31, 1920. This committee reported that the company could not pay more under existing circumstances; that a further fare increase would not secure additional receipts, and that an increase in the wage base was only practical through operating economies.

To this end the committee recommended the adoption of the safety car on several lines. Cars of this type are forbidden on the city streets by ordinance, but the committee recommended that the prohibitory ordinance be repealed. The company agreed that if this plan was followed it would pay 52½ cents an hour until Sept. 15, 1920, and then 55 cents for two-man operation and 60 cents for one-man operation. The men immediately went to a demand for 60 cents two-man and 65 cents one-man operation. In refusing the company's proposition they went on strike at midnight on March 1.

COMPANY NOTIFIED TO START CARS

Later the Council voted to visit cities where safety cars were being operated, but only four Aldermen reported when the train was to leave, the Mayor, City Attorney and three Aldermen dodging the responsibility. Gary and Terre Haute were visited by the four Aldermen and a representative of the Federation of Labor. One Alderman went only to Gary, returning because of illness. He gave to the local press unqualified approval of the safety car operation. When the others returned they declined to formulate a report until the other city authorities had made a similar inspection and could join in a recommendation. To the present time this has not been done.

On March 26, 1920, the City Council passed a resolution notifying the company to settle with the men and start the cars within twenty-four hours, and also directing the City Attorney to advise the Council what the city's rights were. As the franchise specifically states that failure to operate cars because of a strike shall not "work a forfeiture" the company has been content to await action of the City Attorney. If the city carries its case to the District Judge the court may await the report of the auditors and appraisers as a guide to his decision. There the matter rested just before the election.

Court Inquiry at Toledo to Start April 22

If Figures Submitted by Railway Are Upheld Fare at Toledo May Be 10 Cents

Federal Judge John M. Killits hopes to be able to keep the railway lines of the Toledo Railways & Light Company operating under the suspension of the "ouster" ordinance till a permanent settlement of the quarter century problem has been effected. Service was resumed in Toledo after a four-day strike when the court granted an increase in fare. The court is relying on the application of the Miller public utilities abandonment law to set aside the effect of the "ouster" after May 1, to which time it was extended by the City Council. Council in the recent negotiations, in which it refused to extend the "ouster" application or grant increased fare, has indicated that it will not grant any further privileges to the railway.

JUDGE KILLITS, at the time of granting the order restoring service, declared he would investigate the revenues and costs of the Toledo Railways & Light Company to ascertain whether or not the "7 and 2" fare was justified. His inquiry is scheduled to begin on April 22.

The order provided "that the rates of fare herein set forth shall be subject to revision upon the determination by the court, upon application by either party hereto, of the value of the street railway property and of what will constitute a reasonable rate of return thereon."

While the court will not be permitted to go very deeply into the question of valuation because of the pressure of other business, it is thought a temporary valuation can be arrived at from the recent city inventory and the books of the company.

Court Inquiry Planned

The Judge intends to look into the matter of the production and distribution of electric current by the Rail-Light and also by the Acme Power Company, owned by the same interests, but in no way related to the Toledo Railways & Light Company. It has been charged by city officials that the railway is paying "velvet" to the power company which earns revenue for the same stockholders.

If company figures submitted to the city, and approved by special accountants, are upheld by the court a 10-cent fare may become a possibility as a "reasonable return" on the investment in the railway.

The two commissions working on solutions for the problem of transportation for Toledo have about one month more in which to complete their work and submit it to the people of the city. The municipal ownership body will recommend that Council appropriate a sum sufficient to establish a modern transportation system; that it acquire by condemnation or otherwise such portions of the present street car lines as it deems necessary for a model system; that the Mayor shall name a commission to determine what lines shall be retained and what routes established, as its plan to secure public ownership of the street railway system in Toledo.

A resolution embodying these principles will be drawn up and presented to the Council within the next week.

The commissioners are in favor of building a new street railway system by using parts of the present lines. They have given up any idea of buying the entire property of the Toledo Railways & Light Company, because Henry L. Doherty has failed to quote them his absolute cash price on the property. He offered it for $11,000,000 on a part-time basis.

Commissioners Want New Lines

A comprehensive system of motor buses as an auxiliary to the basic railway system is a part of the scheme of the municipal ownership commission. The commission will name in its resolution what it deems a reasonable amount to be expended by the city for a transportation system.

Henry L. Doherty declared only last week that he would not listen to any proposal which would seek to take parts of the lines and leave other parts to be sold as junk.

City Law Director James S. Martin has advised the municipal ownership commission that there is very little legal precedent for a city to condemn only portions of a public utility. The railway is operating without franchise from the city.

The cost-of-service commission has begun the task of comparing its ordinance section by section with the Doherty corrections and in the consideration of the first twelve sections has adopted most of the Doherty suggestions.

The commission will submit its final draft, embodying changes, to several Toledo attorneys before again turning it back to the federal court for submission to Council.

It is planned to have the two measures ready for submission to Council about May 1 and these will probably be ready for a referendum about June 1.

Dallas Approves Interurban Road

The voters of Dallas, Tex., passed favorably at the city election there on April 6 on the question whether the proposed Dallas-Wichita Falls interurban line shall be substituted for two of the 30-mile interurban lines that must be built by the Strickland-Hobson interests which took over the railway lines of Dallas several years ago under the service-at-cost franchise. J. F. Strickland has indicated that his company would take over the Dallas-Wichita Falls proposition and build the line if this action will be accepted by the city as discharging its obligation to build two 30-mile lines and to guarantee which it is under bond to the city.

Mayor Frank W. Wozencraft said doubtless the City Commission had the authority to grant the substitution, but he believed the people of the city should have an opportunity to pass on the question. For this reason it was decided to submit the matter to a referendum. The Wichita Falls line will be 130 miles long and will touch Denton, Slidell, Gainesville, Decatur, Henrietta and several other smaller towns. Surveys have already been completed and estimates made.

Pittsburgh Will Discuss Service at Cost

A plan whereby the Pittsburgh (Pa.) Railways will give the city of Pittsburgh service at cost will be worked out with the reorganization of the company by representatives of the city and the company, it was announced, on April 1, following the final meeting for the present of the Mayor's traction conference. The plan, it is believed, will mean a revolutionary change in the relationship between the receivers of the Pittsburgh Railways and the city.

At the close of the conference the following statement was issued:

Attorneys for the city and the Pittsburgh Railways, with Robert M. Feustel, consulting engineer for the city, will immediately begin negotiations with a view to attempting to establish a service-at-cost plan for the Pittsburgh district in the operation of the Pittsburgh Railways, such as has been worked out in other large cities, notably Cleveland and Cincinnati.

This will be done in connection with the proposed rehabilitation and reorganization of the railways company.

Details of the plan, when worked out, will be reported back to the Mayor and Council at the earliest possible date. In the meantime, attorneys for the city will take any steps believed necessary to protect the city's interest in case these negotiations fail.

Worcester-Springfield Demands Rejected

Identical demands for new working agreements, to become effective on June 1, when the present contracts expire have been made by the trainmen of the Springfield (Mass.) Street Railway and the men on the Worcester Consolidated, in a communication delivered to Clark V. Wood, president.

An increase from the present maximum of $5.13 for nine hours to $6.40 for eight hours for motormen and conductors and 40 per cent advance for miscellaneous help is demanded. According to the schedule proposed, the new rates of pay for platform help would be $5.20 a day for the first three months, $5.80 for the following nine months and $6.40 after a year. The present rates are $4.23, $4.68 and $5.13.

Mr. Wood intimated that a very substantial increase in fares would be necessary to carry out such a salary program.

New York Mayors for Home Rule

A declaration for home rule for the cities of New York State in the matter of regulating fares was voiced at Rochester on April 10 at a meeting of the special committee appointed by the New York State Conference of Mayors to study the railway situation as it affects the various cities. The particular purpose of the meeting was to lay plans for the aggressive opposition which the committee intends to wage for the Mayors' Conference against the Jenks bills now before the Legislature. After a session which lasted for several hours the special committee epitomized its attitude with regard to the Jenks bills in the statement which follows:

> The committee is opposed to the bill to give to the Public Service Commission power to increase street railway fares irrespective of franchise restrictions, special statutes or agreement, because a franchise is a contract that has been made by a city with a company.
>
> The need for increasing fares in those thirty-six cities which have franchises restricting rates of fare is a matter for each of these municipalities to determine for itself. The courts have repeatedly declared that the State has authorized these cities to exact fare restrictions when granting franchises, and the Constitution provides for the protection of these contractual provisions when made.
>
> In twenty of these thirty-six cities the administrations have permitted the companies to increase these fares temporarily. In eight others the companies have not requested any increase in fares, and in the remainder, the authorities have refused to permit the companies to raise the fares because they are not satisfied with the reasonableness of the companies' claims. We believe that the action of these cities demonstrates conclusively that local authorities are able to arrange their traction affairs themselves.
>
> We are opposed in its present form also to the so-called service-at-cost bill. If the measure simply gave to cities authority to enter into service-at-cost contracts with traction companies, we should approve it. Municipalities should have such power. This measure, however, provides that every city either must enter into a service-at-cost contract or must surrender its franchise rights by permitting the Public Service Commission to fix the rate of fare regardless of restrictions or agreements.
>
> We are, therefore, opposed to the bill.

Akron Men Want $1 an Hour

Employees of the Northern Ohio Traction & Light Company at Akron, Canton, Massillon and other points, in addition to an increase of wages to $1 an hour, have included in their demands the requirement that 90 per cent of the runs be completed within the eight-hour period, an hour's additional pay for filling out accident reports, free transportation for the families of employees over the company's lines, discharge of any employee who violates the rules of the union, reinstatement of employees who resign if the application is made within six months, the reinstatement to be at the same wages the men received when they resigned. All new men are also to be required to become members of the union within thirty days after they begin work for the company.

Officials of the company say that to grant the demands would mean an addition of $1,560,000 annually to the payroll for the trainmen alone. Just what offer the company is prepared to make has not been stated. The contract with the union provides for arbitration of wage differences, the board to be made up of one man selected by the company, one selected by the men and the third by the Governor of the State.

Three-Cent Wage Increase in Philadelphia

Announcement was made on April 13 by the Philadelphia (Pa.) Rapid Transit Company that wages of motormen and conductors will be increased 3 cents an hour, making the maximum 61 cents an hour, effective on May 1. The wages of employees in other departments will be increased proportionately, effective the same date.

The co-operative plan provides a basis for determining the wages of the employees of the company, which shall be the average wage scale of four cities: Chicago, Cleveland, Detroit and Buffalo. Buffalo's trainmen's wages have been increased to 60 cents an hour, effective on May 1. This establishes the new maximum of 61 cents an hour for Philadelphia. The general committee of the Employees' Co-operative Welfare Association approved the new rate at a meeting held on April 13.

The gospel of thrift has been practiced by more than 70 per cent of the 9,400 employees eligible to membership in the saving fund. They have authorized the treasurer to make deductions from their pay envelopes each week. The average saving each month for each employee is $10. The aggregate savings exceed $780,000 annually.

It is expected that the men will increase their savings account, as the added weekly wage is about $1.65 to each employee. Officers of the saving fund are confident that at the annual picnic of the Co-operative Welfare Association the saving fund will exceed $1,000,000. Practical aid in saving is extended to employees through the Co-operative Welfare Association's simplified budget system for determining a household budget and keeping expense records.

Tugaloo Development to Be Pushed

The proposed Tugaloo hydro-electric development of the Georgia Railway & Power Company, Atlanta, Ga., will be located on the Tugaloo River, immediately below the junction of the Tallulah and Chattooga Rivers, where the Tugaloo is first formed.

A power house, 60 ft. by 190 ft., will be located immediately below the dam. It will have an installed capacity of approximately 75,000 hp. in water wheels. There will be four wheels of 18,750 hp. each, direct connected to 6,600-volt, three-phase, 60-cycle vertical type alternators of 12,500-kw. capacity each. The transformation from 6,600 volts to line voltage of 110,000 volts will be accomplished through two banks of power transformers of 25,000-kw. capacity each. Each bank of transformers will consist of three single-phase units. A new 110,000-volt transmission line, about 8 miles in length, will also be constructed for delivering the power from this plant to the present double circuit 110,000-volt steel tower line extending from the present Tallulah Falls plant to the city of Atlanta, Atlanta being the central distributing point for the transmission system of the Georgia Railway & Power Company. In addition to supplying current to Atlanta and other communities the company operates 230 miles of track.

Active construction work on this project was begun some two years ago. Contracts were then placed for the water wheels with the S. Morgan Smith Company, York, Pa., and for the generators with the General Electric Company. A part of the steel work and considerable other equipment have also been purchased. The construction was held up for the past eighteen months because of conditions resulting from the war. It will now be pushed as rapidly as possible.

All of the work on the project will be handled by day labor, under the company's own construction organization, of which Charles G. Adsit is chief engineer.

Wage Demands Rejected by Cleveland Railway

J. J. Stanley, president of the Cleveland (Ohio) Railway, on April 12 sent a communication to the officers of the local union, in which he stated that the company is compelled to refuse the demands of the men for an increase in wages to 90 cents an hour and new conditions as to time and runs. His letter contained the following proposals:

> 1. That all demands, whether of the company or the men, be submitted to arbitration immediately.
> 2. That both sides waive the privileges of the time in the present contract for naming representatives to the board of arbitration.
> 3. That C. Loomis Allen, vice-president and general manager of the Syracuse & Suburban Railroad, Syracuse, N. Y., be named forthwith to act for the Cleveland Railway.
> 4. That in case Mr. Allen and the arbitrator to be named by the men fail at their first session to agree on a third man, the Federal Judge of the District appoint the umpire.

The letter also contained counter demands, in effect as follows:

> 1. That restrictions as to sex of conductors and motormen on cars be removed.
> 2. That the clause which now provides that such employees "shall" become members of the union be changed to read only that they "may" join the union.
> 3. That compensation other than straight time rates (this affects split-shift runs) be abolished.
> 4. That there be a higher rate of pay for motormen than for conductors, if any pay changes be made at all.
> 5. That the present agreement remain in effect pending the results of arbitration.

Mr. Stanley said that, in fairness to the public, he feels that the increase should not be granted. The cost of living has not increased materially since last July, when the present terms were made, following the strike.

Officials of the union refused to express any opinion on Mr. Stanley's letter until they had taken time to study it thoroughly.

Wage Reduction in Denver

The Denver (Col.) Tramway has served notice on the local branch of the Amalgamated Association that effective June 1 the agreement between them will be canceled and the wage scales reduced from 58 cents an hour maximum for trainmen to the 48-cent scale established by the National War Labor Board. Jurisdiction over the case was assumed by the Colorado Industrial Commission on April 3.

Initiative petitions calling for the passage of an ordinance authorizing the collection of a 7-cent fare have been circulated by the company and will be filed with the municipal authorities. The City Council has thirty days within which to act after the petitions are certified to it and must either pass the measure or refer it to a vote of the people at the next regular municipal election, which will be held in the spring of 1921.

The company will make no campaign for the passage of the ordinance. It will limit its activities to the initiation of such measure and leave entirely to the municipal authorities the determination as to whether the rate of fare shall be 7 cents with the 58-cent wage scale or 6 cents with the 48-cent National War Labor Board wage scale.

A local board of arbitration on March 19 had granted the trainmen a 10-cent an hour increase, with corresponding increases for employees in other departments. This advance the company is unable to meet from the revenues derived from its present 6-cent fare.

Ex-Governor Compiling History of Union Crimes

Ex-Governor Joseph M. Brown of Georgia, whose protest to the President against union domination was noted in the ELECTRIC RAILWAY JOURNAL for March 13, page 535, wrote to the Atlanta *Journal* during the recent strike of the trainmen of the Georgia Railway & Power Company advising against resort by labor or its sympathizers to such tactics of frightfulness as characterized the railway strike in October, 1916. Mr. Brown is the avowed foe of force as exemplified in the labor bomb thrower. Among other things he said in the *Journal*:

> I will add that I am now making research into the course of the Amalgamated Association in "enforcing its demands" upon the public, and up to the present date have secured record of more than forty cities in which riots, with destruction of property and unlawful wounding and killing of people, were the accompaniment of strikes by this Amalgamated Association. These states include Maine, New York, New Jersey, North Carolina and Georgia on the Atlantic Ocean and Washington and California on the Pacific Ocean, with various states between the two oceans.
>
> When this record has been completed I shall lay it before Congress and before the Georgia Legislature and I shall ask Congress if, while it is holding on the statute books laws to control corporations which conduct interstate commerce, it will continue concurrently to leave non-incorporated organizations of men free to conduct at their pleasure interstate crime. And I shall ask the Legislature of Georgia some pertinent questions and make some suggestions to that body for protecting the people.

News Notes

$450,000 Carhouse Fire.—The Winnipeg (Man.) Electric Railway lost its Main Street carhouse in a fire on April 7. On account of the lateness of the receipt of this news, it is found necessary to include this item in the department Manufacturers and the Markets.

Boston Wages to Be Arbitrated.—The new wage demands of union employees of the Boston (Mass.) Elevated Railway will go to arbitration, according to a decision reached at a conference between the trustees and the men's representatives on April 9.

Dayton Road Increases Wages.—On April 6 the Dayton, Covington & Piqua Traction Company, Dayton, Ohio, increased the wages of its trainmen 3 cents an hour. This is the fourth 3-cent increase within a year. Employees in Dayton and Hamilton will now receive 50 cents an hour, while members of interurban crews will receive 51 cents an hour.

Commissioners Complain Franchises Are Violated.—Commissioners of Stark County have prepared charges against the Northern Ohio Traction & Light Company, Akron, Ohio, to the effect that the terms of the franchises are being violated in respect to rates of fare between Canton and Massillon and Massillon and Navarre. Application will be made to the Public Utilities Commission to adjust the matter.

Peoria Men Want More.—Trainmen of the Peoria (Ill.) Railway are asking for the wage scale of 80, 83 and 85 cents an hour with a basic nine-hour day. The present agreement of the men with the company expires on April 30. Arbitration is provided in the event of failure of the men and company to agree. Officials of the company state that if an increase of pay is granted to the men an advance in fare will be essential.

Conference on One-Man Car Operation.—Pending a conference between union representatives and officials of the Connecticut Company, the local employees of the company at Bridgeport on April 10 decided to assume runs on "one-man" cars on April 11, when the new service schedule of the company became effective. The men had protested the operation of "one-man" cars where zone fares are collected on the ground that it puts too much work on the motorman.

New Youngstown Scale Accepted.—Acceptance of the increase in wages offered by the Pennsylvania-Ohio Electric Company, Youngstown, Ohio, has probably averted a strike of 800 motormen and conductors in Sharon, Youngstown, Newcastle and Warren. The employees demanded that they be paid 70, 73 and 75 cents an hour according to the length of service. The company refused the demand and a compromise rate of 60, 63 and 68 cents was accepted. The scale will date from April 1.

Sioux City Men Want More.—Demands of a 60 per cent increase in wages, a nine-hour day and a "closed shop" were made on the Sioux City (Iowa) Service Company by the trainmen's union, forecasting a fight that eventually may culminate in a movement for increased fares. When the present scale of wages was agreed on a year ago Service Company officials announced that company finances had reached the "breaking point." No further increase would be granted, it was intimated, without reciprocal action for a 6 or 7-cent fare.

Strike in Spartanburg.—Union trainmen in the employ of the South Carolina Light, Power & Railway Company at Spartanburg, S. C., went on strike on April 1. They want an increase in wages and a change in working conditions. The men charge discrimination against members of the union. An advance in pay of 5 cents an hour was made by the company recently, but the men say that the advance was negatived by other company modifications. On April 5 service had been restored in part with non-union men.

This "Ghost" Doesn't Walk Regularly.—Employees of the Norton & Taunton Street Railway, which is owned by the cities of Taunton and Attleboro, and the towns of Mansfield and Norton, in Massachusetts, were authority for the statement on April 5 that they had not "seen the ghost walk" for three weeks and that unless money was forthcoming soon they would be forced to quit the cars and get the wherewithal for daily maintenance from other sources. The men claimed that money is still due them for work done shoveling snow during the big storm. The men tell of one conductor who turned in his receipts with a note informing the company that he was $10 short simply because he needed the money.

Group Insurance for Key Route Men.—The directors of the San Francisco-Oakland Terminal Railways, Oakland, Cal., have arranged to insure the lives of all the regular employees without cost to them and without medical examination. This consideration is thus extended in recognition of service faithfully and loyally performed and to be performed. In announcing the plan the company said: "It is extended in the expectation that it will provide a means through which any dependent will be protected against immediate need and even afforded an opportunity to start anew. It is extended to the end that the employee will find satisfaction and contentment in the knowledge that whatever may befall, so long as he renders faithful and efficient service, something will be left for the protection of those dependent upon him.

Financial and Corporate

Surplus Account Up

Earnings of Holding Company Materially Increased—North American Company Has Prosperous Year

The annual report for the year 1919 of the North American Company, New York, indicates increased revenues and decreased expenses, thereby giving a material increase in the surplus account even after the payment of four quarterly dividends, each of 1.25 per cent on the $29,793,300 of outstanding capital stock.

No changes are noted in the valuations of the stocks and bonds of street railway, electric light and gas companies owned by the company. Loans and advances consist of money advanced to subsidiary companies. The only important change during the year is the reduction in notes payable from $4,177,500 to $500,000, which since has been reduced one-half. The reduction in loans of $3,677,500 and the payment of dividends aggregating $1,499,665, involving total cash disbursements of $5,167,165 during the year, were accomplished through repayment by subsidiary companies of moneys previously advanced to them, and the receipt in cash of interest and dividends from earnings of subsidiary companies. The accompanying table, gives in detail a comparison between the income and undivided profits for the past two years.

INCOME AND UNDIVIDED PROFITS ACCOUNTS OF THE NORTH AMERICAN COMPANY

Year Ended Dec. 31	1919	1918	Per Cent Change + Inc. − Dec.
Interest received or accrued	$483,331	$573,608	− 15.75
Dividends received or accrued	2,279,318	1,390,435	+ 63.90
Profits and compensations for services	33,592	33,837	− 0.72
Total revenues	$2,796,241	$1,997,880	+ 40.00
Salaries, legal expenses, net rentals and all other administration expenses and taxes	$130,422	$131,341	− 0.70
Interest paid or accrued	119,152	262,465	− 54.60
Sundry accounts written off	700		
Total expenses	$250,274	$393,806	− 48.90
Net income	$2,545,967	$1,604,074	+ 58.60
Dividends paid and accrued during year	1,489,665	1,489,665	
Balance carried to undivided profits account	$1,056,302	$114,409	+ 822.00

Shore Line Lease Abrogated

The New London division of the Shore Line Electric Railway, Norwich, Conn., has reverted to the Connecticut Company, New Haven, Conn. This division includes the New London and Norwich local lines. It extends through New London and Windham Counties to the Massachusetts State line at Wilsonville and includes the Putnam line. The division has been operated by the Shore Line Electric Railway under a ninety-nine year lease from the Connecticut Company, but the Shore Line is now able to give up this lease by permission of the Superior Court since it went into the hands of a receiver.

In a statement, Robert W. Perkins, the receiver, says in part:

> With a little margin over actual operating expenses the Connecticut Company will be able to spend a little more money on maintenance of roadway and rolling stock, give additional service and provide some more modern equipment, but it should be borne in mind that in order to provide adequate service, and a reasonable return on the investment, the gross revenue must be increased and any change in passenger fares which the Connecticut Company may find it necessary to adopt should be accepted as an inevitable consequence of the increased cost of producing the service, for, after all, the community should be more interested in service than in the price it pays for it provided that price does not give to the owners of the property a return above that common to other industries. If operations do not result in such a return, service will have to terminate.

The Connecticut Company has also issued a statement in which it says in part:

> The direction of affairs will be under the local supervision of Samuel Anderson, who filled the position of manager of the same properties during the period of operation by the Connecticut Company.
>
> It is the intention to install safety cars for local service in both New London and Norwich as soon as such cars, now on order, can be delivered and operation of all lines will be continued for the present and until we have had an opportunity to determine what changes must be made to meet the patronage accorded the service.
>
> The prevailing rates of fare will be continued for a time in order to allow a complete study to be made of conditions and revenues in various localities. Ample notice will be given in advance of any changes which may be required.
>
> We hope that we may be able to provide a character of service that will invite the patronage of a sufficiently large number of passengers at such rates of fare as will provide us with funds required to keep the service going, and as the communities depend largely upon the means of transportation we appeal to the public for co-operation in our effort to solve the problem of your street railway.

City Must Pay Appeal Cost

The United States Supreme Court has denied the request of Kansas City that the Kansas City Railways be compelled to pay for printing part of the record in the recent unsuccessful legal attempt of the city to set aside the order of the State Public Utilities Commission in allowing higher fares.

Pittsburgh Valuation Protested

City Considers Recent Commission Decision Misleading—Thirteen Objections Specified

The Pennsylvania State Public Service Commission's decision valuing the properties of the Pittsburgh Railways at $62,500,000 is branded as "misleading and prejudicial to the rights" of the city. The commission is asked to "set forth" definitely and clearly that its decision was solely for reorganization purposes and is not to be accepted as a basis for fares in Pittsburgh in a petition for a rehearing in the matter filed on April 8 in behalf of the city of Pittsburgh.

The city filed the petition as a "safeguard" against any attempt that might be made to advance the present fare to a 10-cent flat rate, in view of the demands of the motormen and conductors for an increase in wages to a maximum of 91 cents an hour.

A number of other municipalities and the committee on better service of the allied boards of trade also are filing petitions for a rehearing on the commission's valuation decision, which Special City Counsel Robinson has declared means, if it stands, a straight 10-cent fare in Pittsburgh.

CITY'S OBJECTIONS SUMMARIZED

In thirteen specific instances, the city in its petition for a rehearing charges, the commission erred in its valuation decision, and these "thirteen counts," as the city sets them forth, summarized, are as follows:

1. The commission erred in finding the value of the properties for reorganizing and refinancing upon a complaint alleging unreasonable rate of fare.
2. The commission was without jurisdiction in acting as though the evidence had been taken upon an application for a certificate of valuation.
3. The commission erred in attempting to set a valuation without having evidence of the market value of the stocks and bonds of the companies.
4. Interest on debenture bonds amounting to $600,000 and interest and principal on car trusts, amounting to $312,471 for 1920, are not chargeable to fixed expense, as was done in the commission's report, and should be deducted from the annual fixed charges of $4,200,000.

ERROR IN AVERAGING PRICES

5. The commission erred in taking as the basis for reproduction cost range of prices from 1914 to 1918, when prices were abnormally high.
6. The commission erred in not deducting cost of financing from the capital account.
7. Depreciation was not deducted from reproduction cost.
8. Superseded property and depreciation was not deducted from historic cost, to the extent that past earnings were in excess of 7 per cent.
9. Excessive sums were allowed for consolidation costs and consolidation values.
10. Properties not used or useful for street railway purposes were included in the valuation.
11. The commission should have ascertained actual gross income of the company during recent months, which naturally exceeded returns of September and October.
12. Its action in placing a valuation upon the property when it was not asked for by the petitioners is misleading and prejudicial to the rights of the complainant and not a proper basis for rate making purposes.
13. The commission erred in approving fare increase when such session set aside ordinances fixing the rate of fare.

$5,154,332 Duluth Value

Local Railway Appraised in Connection with Fare Vote Which Is to Be Held on June 21

The Duluth (Minn.) Street Railway has been appraised by Hagenah & Erickson, Chicago, Ill., in connection with the fare matter referred to elsewhere in this issue. Three sets of figures are presented, varying considerably with the level of prices used. The appraisal based on the average of labor and material prices which prevailed during the five-year period ended Dec. 31, 1919, follows:

	Reproduction Cost New	Reproduction Cost Less Depreciation
Physical property	$4,930,539	$4,362,332
Working capital	192,000	192,000
Going concern value	600,000	600,000
Total	$5,722,539	$5,154,322

The appraisal based on the level of labor and material prices indicated by the trend of prices as reflected by the continuation from 1914 to 1919 of the normal price movement which was established during the period from 1896 to the beginning of the European war, follows:

	Reproduction Cost New	Reproduction Cost Less Depreciation
Physical property	$4,383,069	$3,886,023
Working capital	192,000	192,000
Going concern value	600,000	600,000
Total	$5,175,069	$4,678,023

The appraisal based on the level of labor and material prices which prevailed during 1918 and 1919 and which reflects the level of prices which will probably continue for a number of years in the future, follows:

	Reproduction Cost New	Reproduction Cost Less Depreciation
Physical property	$5,638,093	$4,977,894
Working capital	192,000	192,000
Going concern value	600,000	600,000
Total	$6,430,093	$5,769,894

The figures are as of Dec. 31, 1919.

Under the conditions which have prevailed for several years and which will undoubtedly exist for a number of years in the future the appraisers reported that the results based on the normal trend of prices were indicative of a lower value than can be justly considered, and against that they submitted the appraisal results based on the present level of prices, which reflect that level to which all business and private industries are now seeking to adjust themselves. They said:

> Between the two extremes we believe that the appraisal results based on the average of the labor and material prices which have prevailed during the last five years more nearly represent a just basis for rate-making purposes, and from a consideration of all of the facts it is our conclusion that the fair value of the property represented by the Duluth division of your company is not less than $5,154,322, and that such amount should be considered as the minimum valuation on which your company is entitled to receive that measure of return contemplated by law.

Mayor C. R. Magney objected to one item in the valuation figures. The company claimed $600,000 as its "going concern value." The Mayor contended that if the company claims that it is on the verge of bankruptcy, it is ridiculous to suppose that it has an "intangible going concern value of more than $500,000" on which to expect a return in the shape of dividends.

In arriving at this item the company's appraisers said they were guided by facts obtained from the history of the company and by a consideration of the actual investment in property and the earnings and operating expenses over a period of thirty years. They also determined what would be the normal cost to reproduce the present business of the company and further considered the provisions which have been made by the courts and public service commissions covering this item of property in the appraisals of public utility companies.

EXTENT OF PROPERTY REVIEWED

The Duluth Street Railway serves a population of approximately 100,000. It owns and operates a total of 76.83 miles of track, measured as single track. The company owns no power plant, but purchases electric power from the Great Northern Power Company, measured to the Duluth Street Railway on the direct current side of the station, the power company thus bearing the loss in transmission. As a part of its property in Duluth the company owns and operates an inclined railway for carrying passengers from the main business thoroughfare to the heights and bluffs. This inclined railway consists of 2,971.3 ft. of track, of which amount 2,749.9 ft. are located on steel trestles while 221.4 ft. are on masonary foundation. The equipment devoted to the operation of this inclined railway embraces two cars operated from control apparatus located at the top of the incline, the cars being operated so as to serve seven waiting rooms and large upper and lower loading and unloading platforms.

In addition, the company owns a substantial modern brick office building. This adjoins its principal carhouse and repair shops. The company owns two substations in Duluth. The rolling stock consists of 160 revenue passenger cars.

Texas Road Reports Increase

Gross earnings of the Northern Texas Traction Company, operating in Fort Worth, Tex., and between Fort Worth and Dallas, for the calendar year of 1919 amounted to $3,264,565. The operating expenses during this period were $2,631,093. During the year extensions costing $276,224 were made. The maintenance cost was $233,935. Miscellaneous expense is listed at $217,329, labor $931,840 and fixed charges and interest, $380,433. Fares in Fort Worth are 5 cents for adults, or twenty-two tickets for $1, with a 2½-cent fare for children and students or forty tickets for $1. Interurban tickets sell for 2 cents a mile. Of the total income reported, $2,977,851 was derived from fares and tickets.

Abandonment Protested

It was stated at the hearing before Chairman Hill of the Public Service Commission for the Second District of New York, on April 3, that the Port Jervis (N. Y.) Traction Company had taken steps for abandonment of its franchises in Port Jervis. This statement was by John B. Knox, New York, representing the company, on the hearing of an order to show cause why the railway abandoned operations in Port Jervis.

Mr. Knox admitted all the city's claims about non-operation, but denied that the company had violated the law. The company was operating at a deficit, he said; it had paid no interest on bonds for six years; it had borrowed money to pay taxes, and it was absolutely impossible for the company to run. The company, he said, is insolvent.

Corporation Counsel William A. Parshall objected to the company's abrogating terms of its franchise. He expressed surprise at the company's declared intention to abandon its road. This position, he maintained, was untenable. The company's ceasing operations was indefensible and Port Jervis, he told Chairman Hill, went further than any other city to help the company, even waiving all fare restriction and consenting to the commission's determination of a reasonable rate. Mr. Parshall asked that the commission direct the company to resume operations, saying the Port Jervis authorities were not "corporation baiters." He contended the company could not abandon operations.

Mr. Knox said the company had taken steps for dissolution. He said: "We are getting ready to go out of business."

Mayor George E. Hornbook, William M. Tuscan and P. E. Rutan represented the Chamber of Commerce.

Chairman Hill said an early decision will be rendered.

New Plan for Service in Hyde Park District

At a meeting of the trustees of the Boston (Mass.) Elevated Railway and the Eastern Massachusetts Street Railway a new plan for the service in the Hyde Park District was adopted. The plan provides for the operation of the cars on the Hyde Park division as far as the boundary lines of Hyde Park as they existed before being incorporated in the city of Boston by the Eastern Massachusetts Street Railway. Within this line, included in the city of Boston, the Boston Elevated Railway will operate.

The Hyde Park district will be relieved of the obligation of contributing to the cost of operation of the Boston Elevated Railway or sharing in the assessments necessary to meet any deficit. On the other hand, this district will be called upon to pay over to the Eastern Massachusetts Street Railway an equivalent amount toward any deficit this company may incur.

Fare Increase Beneficial

Traffic Losses in Lexington Not Sufficient to Show a Decrease in Gross

The annual report of the Kentucky Securities Corporation for the year ended June 30, 1919, gives the following information concerning the Kentucky Traction & Terminal Company, one of its subsidiaries:

PROSPEROUS CONDITION SHOWN

The railway gross earnings reflect the generally prosperous business conditions that prevail and receipts show an increase of $37,172. This increase is largely due to the fare increase on the interurban lines, for in April, 1918, the cash fares were increased from 2.5 to 3 cents per mile and through fares from Lexington to Frankfort, Georgetown, Paris and Nicholsville were increased 5 cents on each one-way ticket. In September, 1918, the unit rate of fare on all city lines was increased from 5 to 6 cents.

The total number of passengers carried, both cash and transfers, however, decreased 8.12 per cent, this being due in many respects to the increase in fare and to the restricted riding during the influenza epidemic in the fall of 1918, as well as the discontinuance during the war of the several annual county fairs. The largest traffic loss was 14.7 on the Lexington city lines.

In the city of Lexington one-man operation of cars was inaugurated during the year on all local city lines.

The accompanying table gives information as to the extent of the system, the rolling stock and the traffic handled:

TRACK MILEAGE

Interurban system:		
Main line	65.87	
Sidings and spurs	1.80	67.67
City lines:		
In Lexington	16.02	
In Frankfort	7.64	
In Georgetown	1.26	
In Winchester	1.20	26.12
Total track mileage		93.79

Rolling stock:	Total
Passenger city cars	*47
Passenger interurban cars	15
Freight cars	4
Service cars	6
Total cars owned	72

*Includes 14 cross-bend open cars.
Year ended June 30

	1919	1918	Per Cent Change +Inc. —Dec.
Passenger traffic—cash and transfers—			
Lexington city lines	1,415,989	1,660,133	—14.70
Other city lines	388,065	426,624	— 9.04
Interurban lines	3,751,883	3,959,734	— 5.25
Total passengers	5,555,937	6,046,491	— 8.12

$1,447,363 Refused on Principle

The city authorities of Chicago on April 10 refused to accept $1,447,363 from the Chicago Surface Lines. This was the total of two checks, one from the Chicago Railways for $1,004,372 and the other from the Chicago City Railway for $442,991—each representing 55 per cent of the net receipts of the companies for the fiscal year ended Jan. 31, 1920.

Tender of the checks was made by M. B. Orde, treasurer of the Surface Lines, under the terms of the 1907 ordinances which require that payment be made by April 10 of each year. The city law department has contended that when the surface companies abandoned the ordinance rate of fare and began collecting 6 cents under authority of the State Utilities Commission they forfeited all rights under the city franchise. Therefore, when the checks were offered to the city comptroller he called upon Special Counsel Cleveland for an opinion, and the latter said the money should not be accepted unless the companies would enter a stipulation that this would not be construed as an admission by the city that the 6-cent fare was legal. This the companies refused to do.

Paving Charges Withdrawn

The City Council of Wausau, Wis., has adopted an ordinance permitting the construction of extensions to the existing system operated by the Wisconsin Valley Electric Company, in Wausau, which provided for the replacement of track torn up by the company in its construction work, but relieving the company of the obligations to repave or to maintain the pavement. In the ordinance appears this section:

Whereas, the statutes for the regulation of rates, service and operation of street railways that have been enacted since the granting of the existing franchises of the said street railway company by said ordinances placing street railway companies under the control and supervision of the Railroad Commission make ample provision for the protection of the interests of the public and cause the burdens as to street paving imposed by said franchises upon the said street railway company to result in increased cost to that portion of the public who use said street railways.

The adoption of the ordinance followed the report of a committee of the Council appointed to investigate the matter. In its report to the Council, the committee said, among other things:

The original street railroad franchises were adopted prior to the enactment of the present public utility laws, which place the control of the rates and of the service of all street railroads in this state under the exclusive control of the railroad commission of Wisconsin. This condition did not exist at the time that these franchises were granted.

Under this law a reduction of operating expenses tends to result in improved service and reduced fares or both, whereas increased operating expenses of the company tend to increase the fares, or curtail the service rendered, or both. And whereas the street railroad is being patronized by working men and women who cannot afford automobiles, it seems proper that no unnecessary expenses be now imposed upon street car lines so that adequate service and reasonable rates of fare can be put into effect and so maintained.

The committee further recommended the passage of an ordinance shifting the cost of paving maintenance, hitherto borne by the company, from the abutting property owners to the city.

Financial News Notes

Abandonment Announced. — The Southern Railway & Light Company announced the abandonment of service on its railway lines in Natchez, Miss., on April 5. The tracks will be torn up and the equipment sold.

Subway's Transfer to State Approved.—The sale and conveyance to the State of Massachusetts of the Cambridge subway for $7,868,000 was formally approval at the annual meeting of stockholders of the Boston Elevated Railway on April 5.

Contribution to the Cost of Operation.—The town of Deerfield, Mass., has been authorized by the Massachusetts Department of Public Utilities to contribute $200 to the Connecticut Valley Street Railway to aid in the cost of operation of the road for the year 1920.

Interest Passed on Income Bonds.—The directors of the Chicago (Ill.) Railways have decided that the year's interest on the company's $2,500,000 of adjustment income bonds was not earned. Consequently no payment will be made May 1. Interest on these bonds was not paid for the previous year.

Receiver for Ohio Interurban—Common Pleas Judge Dan B. Cull at Cleveland, Ohio, on April 4 named Attorney Milton C. Portmann receiver for the Cleveland, Alliance & Mahoning Valley Railroad, Ravenna, Ohio. The company operates 46.5 miles of road. It is said to have defaulted in the payment of $25,000 of interest due on April 1.

Offer to Rehabilitate Abilene Line.—A. Hardgrave, Dallas, Tex., vice-president and general manager of the American Public Service Company, has submitted an offer to the city of Abilene, Tex., whereby the American Public Service Company would take over, rehabilitate and operate the railway system of Abilene. The company proposes to spend $50,000 on improvements if the deal goes through.

Earnings Are Insufficient.—It is expected that the Tri-City Railway will petition the Public Utilities Commission of Illinois for an increase in fare on the Illinois side of the Mississippi. Officials of the company state that it is no longer possible for the company to operate at a 7-cent fare. According to the ruling of the commission, the company is entitled to earnings in Illinois amounting to 7 per cent on $2,000,000. The earnings at present are only 4 per cent on this amount. If the petition is approved by the commission and higher fares are put in effect on the Illinois side the company will probably ask the City Council of Davenport, Iowa, to consider a similar increase in fares in that city.

Traffic and Transportation

Louisville Committee Back

City Considers Recent Commission Decision Misleading—Thirteen Objections Specified

Mayor Smith of Louisville, Ky., and Louisville Railway officials returned to that city recently, after studying electric railway conditions in Cincinnati, Cleveland, Philadelphia, New York and Newark. Mayor Smith stated that no city in the country has as much trackage as Louisville in proportion to the population. Another fact noted was that the rolling stock in Louisville appears to be in better physical condition than that in most other cities. In Cleveland it was noted that through an ordinance prohibiting the use of tracks by traffic other than street cars better time is made by 2 m.p.h. than in Louisville.

SUGGESTIONS OPPOSED

Mayor Smith stated on his return that he favored (a) the elimination of automobile parking on Fourth Street from Main to Broadway; (b) installation of modified zone system of fares, with a 5-cent fare as a basis, and a limited transfer system; (c) freeing car tracks of all other traffic; (d) prevention of looping of cars in the business district.

Already the Retail Merchants' Association, the Automobile Club and other organizations have attacked the suggestion of no parking on Fourth Street. They are also opposed to routing cars one way on Fourth Street. The auto club is especially opposed to suggested non-allowance of tracks for vehicles. The Market Street Merchants' Association is endeavoring to increase looping in the downtown district to bring more business to Market Street, and is consequently opposed to the no-looping plan.

Labor organizations and general consumers are opposed to the zone system, modifications of transfers or anything that would increase expenses for the rider. The City Council has fought every effort made to raise prices. The City Council, however, cannot control transfers to any extent or the elimination of paralleled lines or zoning outside of the city limits on some lines, so that the Mayor may have his way.

MAYOR FAVORS NICKEL FARE

Mayor Smith apparently is in favor of the retention of the 5-cent fare, with charges for transfers, modification of routes and improved city co-operation in keeping tracks clear for rapid transit.

The Mayor, upon his return, gave out an interview in which the following impressions were stated relative to traction conditions in the cities visited:

> I discovered that the burdens on most of the traction companies in Cincinnati, Cleveland, Philadelphia and New Jersey cities were much greater than those of the Louisville Railway. In nearly all of these cities the cost of labor, coal and everything that goes to make the running of a railway is more than it is here.
>
> Nearly every one of these cities compels its railway to pay a certain amount for the repair and the use of the streets. All of these cities, which are much larger than Louisville, have a separate branch of the city government which costs considerable to look after street car traffic.
>
> In every city the tendency is toward doing things that will improve traffic conditions. This was particularly noted in Cleveland, where all traffic is barred from the street car tracks. This is done in order that the cars can make more miles in a day, thus necessitating fewer cars and a faster mode of travel. The system of the Philadelphia Rapid Transit Company impressed me as more progressive than any of the others.
>
> Thomas N. McCarter, president of the Public Service Railway, Newark, N. J., explained the zone system. He thinks it will work out finally, but when he first applied it it lowered property values and had to be abandoned for the time being. Mr. McCarter thinks it will solve the problem to a great extent when the public takes more kindly to it. While I am not committed to this plan, I still maintain it would be a step in the right direction.

Members of the party who went on the trip besides Mayor Smith were: Board of Public Safety Chairman Burlingame, Councilman Isrigg, Alderman Wills and the Louisville Railway's executive committee, W. S. Speed, John W. Barr, Jr., and W. H. Kaye.

Mr. Kirwan, president of the Board of Aldermen, who acted as Mayor during the period that Mayor Smith was in the East, is hostile to any effort to advance fares over a 5-cent basis. His attitude toward higher carfares is shown in the following statement:

> What the company probably needs is more short hauls. I believe that the present General Council is opposed to a raise in fares, at least it was a little while back. Of course, that body will listen to the recommendations of the Mayor and other city officials, but it probably will be stubborn in the matter of increased fares.

Philadelphia Committee Named

A committee representing business and civic organizations of Philadelphia, Pa., has been appointed by Mayor J. Hampton Moore to investigate the transit situation in that city. The committee, named at the suggestion of the Philadelphia Chamber of Commerce, is asked to inquire into the nature of the service furnished by the Philadelphia Rapid Transit Company and to suggest improvements. It will also report on the rights of the city to require the company to operate the Frankford elevated and the Byberry lines, now nearing completion. The membership includes Alba Johnson, president of the Chamber of Commerce; William P. Barba, Dr. Thomas Conway, and others.

Thomas E. Mitten, president of the Philadelphia Rapid Transit Company, has notified Mayor Moore that the company will operate the Frankford line only if the city will furnish all equipment, including trains.

Conciliation Board Ruling

Continuance of Higher Fare in Kenosha Made Contingent Upon Improved Service

The Railroad Commission of Wisconsin has handed down a decision confirming the award of the State Board of Conciliation in the matter of wages of railway employees of the Wisconsin Gas & Electric Company, Kenosha. In addition it has granted the company an increase in the rate of fare to provide for the increase in wages. The new rate of fare is 6 cents cash or nine tickets for 50 cents. Whether or not this rate will be continued after the temporary order expires on July 31 depends upon the service rendered by the company.

In its decision the commission commented upon the rapid growth of Kenosha and the inadequacy of the present street railway system for taking care of the present transportation needs of the city. It pointed out that some double tracking and considerable further line extensions were absolutely necessary, as are also additional cars. The commission did not order any definite amount of improvement or extensions to be made, but stated that the people of the city were as vitally interested in the adequacy of the service as they were in the rate of fare, and that while the company is entitled to a reasonable return upon its investment, it is also under a primary obligation to provide facilities to meet the reasonable public transportation demands.

If the company makes these needed improvements, there will result a considerable increase in the investment and a possibly longer average length of haul. These two considerations make it impossible for the commission to determine what the reasonable rate of fare would then be. When the question of the rate of fare again comes before the commission it states that it will give full consideration to the adequacy of the service and the efforts made to improve it.

The Board of Conciliation granted an increase of 9 cents an hour in the wage scale, making the maximum for the fifth year's service and thereafter 55 cents an hour. This increase will cost the company $18,000 a year. The company operates about 7 miles of railway in Kenosha. It suffered severely from jitney competition until recently, when the jitneys were eliminated by a City Council ordinance.

May Abolish Transfer Charge

The city manager of Norfolk, Va., has started negotiations with officials of the Virginia Railway & Power Company, Richmond, looking to the discontinuance of the 2-cent transfer charge now in effect on the company's lines in Norfolk. The charge for transfers became effective at the time when the fare was raised from 5 cents to 6 cents several months ago.

Duluth to Vote on Fares

Some Measures of Relief Contained in 6-Cent Fare Ordinance—Company Wanted More

Citizens of Duluth, Minn., will on June 21 next vote on an ordinance providing that the Duluth Street Railway may increase its fare from 5 cents to 6 cents. This is the result of the City Council on April 8 having agreed to submit the proposition to the voters by referendum at the June primary election.

The railway asked the Council for a referendum ordinance providing for a fare of 7 cents or four rides for 25 cents, but the City Council turned down the proposition. Later the 6-cent rate ordinance was proposed by the company and accepted by the Council.

A. M. Robertson, Minneapolis, president of the company, declared that with a 6-cent rate the company would be unable to do as much as it would like to do in the way of extensions, but that it would be in a position to meet all reasonable demands. He said:

> We believe that a cash fare of 7 cents and four rides for 25 cents is the lowest fare which will yield the revenue vitally necessary to enable the company to finance extensions, buy new cars, rebuild present cars to the "pay as you enter" type and make other needed improvements, and in accepting the 6-cent rate at this time the company wishes it clearly understood that it is relieved only in part from the difficulties it must overcome in supplying service. We will do the best under the conditions to furnish the people with good service, and with complete co-operation of the city officials and the people we hope to succeed.

Now that the matter of a 6-cent rate is to go before the voters at the June election, the company is in a position, Mr. Robertson said, to place orders for material which will be needed this summer. In the event that the increase is defeated the orders can be canceled without the company losing its priority rights.

Before the ordinance was accepted by the Council there was a series of conferences between the city officials and the company officers at which the necessity was discussed for raising the fare now charged. The company recently had its property appraised by Hagenah & Erickson, Chicago, and according to their figures the fair value of the property in Duluth was not less than $5,154,322. It was contended this was the minimum amount that should be considered on which the company is entitled to receive the measure of return contemplated by law.

Seven Cents in Buffalo

The 7-cent fare authorized by the Public Service Commission will be put into effect on the Buffalo, N. Y., lines of the International Railway at 6 a.m. on April 18. Four tickets will be sold for 25 cents. All outstanding 5-cent tickets will be redeemed by the company at their face value. A show cause order to stay the proposed fare increase was granted on April 14 by Supreme Court Justice Cole. A writ of certiorari was also obtained by counsel representing the city.

George Clinton, Jr., special counsel retained by the municipal authorities to fight the fare increase, made application for the order, which directs the Public Service Commission to show cause in Albany on April 17 why the order for a higher rate of fare should not be stayed pending the determination of the proceedings begun by the city to review the commission's action in granting the 7-cent fare.

The writ of certiorari provides for a review of all proceedings resulting in the commission's 7-cent fare order, papers and other material having to do with the case to be produced within twenty days. If the city is unsuccessful in having the 7-cent fare put off until a later day, the city will ask that the International Railway be required to give 2-cent rebate slips to all passengers.

Zone System Likely

This Plan Appears Best Suited to Meet Needs of Local Company at Houston —Master's Report Approved

The report of Judge Otis Hamblin, special master in chancery, who heard the case of the city of Houston, Tex., versus the Houston Electric Company, wherein the company is seeking authority to charge higher fares in Houston than now permitted, has been approved by Judge J. C. Hutcheson of the United States District Court for the Southern District of Texas.

Immediately upon approval of the report of Judge Hamblin, which fixed the valuation of the company's properties at $6,000,000 and held that the present fares of 5 cents for adults and 2½ cents for children were confiscatory, Judge Hutcheson issued an injunction restraining the city from interfering with the company in levying higher fares than those now charged. The order of the court provides, however, that the city shall have the right to apply to the court for a further decree whenever it shall appear that the railway is earning a sufficient compensa- in granting the 7-cent fare. The 7-cent fare order was issued by the commission several months ago.

Luke C. Bradley, district representative of Stone & Webster, owners of the railway, and city officials have entered into negotiations looking toward an agreement fixing fares. It seems certain that a zone system of fares will be put into effect, whereby 5 cents and 2½ cents will be charged within the business district, with 6 cents and 3 cents within the first zone outside the business district and 7 cents and 3½ cents for the most remote places. The report of Judge Hamblin fixed 8 per cent as a just rate of return on the fixed valuation, and it is believed that the zone system with the graduated fares will yield this return.

Negotiations looking to an agreement between the city and the railway regarding the increased fare to be charged are continuing with satisfactory results.

Portland Relief Plan Declared Illegal

Portland, Ore., is legally unable to carry out recommendations made by the Oregon Public Service Commission for the solution of its transit problems. City Attorney La Roche has filed an opinion to the effect that the city is prohibited by the State constitution from acquiring the trackage or any other part of the physical properties of the Portland Railway, Light & Power Company, with the intent of allowing the corporation to use such properties after the purchase by the city.

Under this opinion the Public Service Commission's suggestion that the city purchase the trackage of the company for the purpose of leasing such tracks to the company at a nominal rental fee becomes impossible unless the State constitution is amended. The opinion is based on Section 9 of Article XI, which reads as follows:

> No county, city, town or other municipal corporation by vote of its citizens or otherwise shall become a stockholder in any joint company, corporation or association whatever, or raise money for, or loan its credit to or in aid of any such company, corporation or association.

The City Attorney's opinion was submitted to a special committee, composed of Commissioners Mann, Barbur and Bigelow, and was supplemented by a later statement reviewing Supreme Court cases in Oregon dealing with similar subjects.

Mayor Baker is in sympathy with efforts to afford relief to the company. He maintains that some plan whereby the company can increase its revenue is essential if the city's transportation system is to remain intact. In a recent statement he pointed out that the city must choose one of three courses: A straight increase in fare, an operating agreement with the company, or municipal ownership. In his statement Mayor Baker said:

> Failure to adopt one of these three measures would send the street railway into the hands of receivers. It is a problem that cannot be evaded and should be the concern of every resident of Portland. Under the opinion given by the City Attorney, it would seem that the main proposal offered by the Public Service Commission cannot be carried out. It now devolves upon the Public Service Commission and the City Council to study the problem further and attempt to work out the proper solution.
>
> I am opposed to municipal ownership of street railways. The experience of Seattle is a lesson. But if increased fares will not give the required relief, and if the city is prohibited from entering into an operation agreement with the company which would bring relief, then acquisition of the entire street railway system in Portland by the city is inevitable.

Eight-Cent Fare Denied

Public Service Commissioner Lewis Nixon of the First District has denied a *pro forma* application by counsel for the receiver of three of the surface lines of the Brooklyn (N. Y.) Rapid Transit Company for permission to charge an 8-cent fare. Counsel for the company stated that the application was made for the purpose of providing grounds for an appeal to the higher courts, where the issue of an increased fare could be fairly tried out.

Transportation News Notes

Zone Fares Increased.—The Northern Massachusetts Street Railway, Athol, Mass., has raised its fare from 6 cents to 10 cents for a ride in two zones. The increase was authorized by the Massachusetts Department of Public Utilities.

Modifies Fare Request.—The Shreveport (La.) Railways has asked the Shreveport City Commission to grant it a 6-cent fare instead of one of 7 cents. The company some time ago petitioned for a 7-cent fare. The present rate is 5 cents.

Seven Cents Asked in Pensacola.—An application has been filed with the Florida Railroad Commission by the Pensacola Electric Company for a 7-cent fare in Pensacola. The State Supreme Court some time ago ruled that the commission had authority to grant fare increases.

Recommends 7-Cent Fare.—At a joint meeting on April 7, committees representing the City Councils of Hampton, Newport News and Phoebus, Va., recommended that the Newport News & Hampton Railway, Gas & Electric Company be permitted to raise its fare. The committees favored the adoption of a 7-cent fare with 3½-cent labor tickets.

Ten Cents in Nashua.—Cash fares of 10 cents became effective in Nashua, N. H., on April 1. The Nashua Street Railway had previously petitioned the State Public Utilities Commission for an increase from the 8-cent cash fare then being charged so as to stimulate the use of tokens. Tokens are sold as formerly at the rate of five for 35 cents.

Wants More in Elmira.—Application has been made to the Public Service Commission for the Second District by the Elmira Water, Light & Railroad Company, Elmira, N. Y., for permission to raise its fare from 5 cents to 6 cents. The Elmira city authorities oppose the granting of the company's petition on the ground that its franchise limits the fare to 5 cents.

Agree on Asheville Fare.—As the result of hearings before Judge Webb of the Superior Court of North Carolina, the Asheville Power & Light Company on April 1 began selling six tickets for 35 cents. Several months ago the State Corporation Commission authorized the company to raise its fare from 5 cents to 6 cents. The city appealed the case to the Superior Court. Judge Webb directed the company to reduce the fare by the sale of six tickets for 35 cents.

Eight Cents Asked in Morgantown.—A hearing has been set by the Public Service Commission of West Virginia for May 11 in the application of the West Virginia Traction & Electric Company, Morgantown, to increase its rates in Morgantown, effective May 15. The company asks the following rates: 8 cents to any point on the Loop division; 8 cents to any point on the Sabraton division. Passengers paying the 8-cent fare may purchase transfers to any point for 3 cents. The fares were last increased on Feb. 14, 1919.

New Transfer in Seattle.—The Seattle (Wash.) Municipal Railway has recently issued a new transfer, designed by Thomas F. Murphine, former superintendent of municipal railways, which it is believed will add considerable revenue to the system. The transfer consists of a ticket 1¼ in. wide by 3 in. high with detachable coupon 1¼ in. wide by 1¼ in. high. The conductor on the car that receives the transfer from the passenger detaches the coupon. Any effort by the holder to use the transfer on another line would come to grief. The transfer is punched for time and direction.

Asks 7 Cents Pending Decision.—The East St. Louis & Suburban Railway, East St. Louis, Ill., has filed a petition with the Illinois Public Utilities Commission for a temporary fare of 7 cents on its city lines pending final ruling of an application for an 8-cent fare. The application states that three tickets would be sold for 20 cents. The commission recently suspended the 8-cent fare until Aug. 23 while the petition was being considered. The company has been contending for more than a 6-cent fare since Sept. 1, 1918, and made application for an 8-cent fare on Sept. 1, 1919.

New York Inquiry Continues.—Despite the withdrawal of the representatives of the railway lines several weeks ago, the New York City Board of Estimate and Apportionment is going ahead with its investigation of the traction situation in the metropolis. The companies' representatives withdrew from participation in the inquiry at the direction of Federal Judge Mayer. At the board's session on April 8 Cornelius M. Sheehan, deputy water commissioner, presented arguments against allowing the Brooklyn Rapid Transit Company and the New York Railways to raise their fares.

Change Unlikely in Montreal Fares.—It is understood that the present tariff of fares in effect on the Montreal (Que.) Tramways, while put into force several months after the beginning of the fiscal year of the company, justifies a belief that it will not be necessary to raise rates on June 30, 1920, the end of the company year, unless abnormal circumstances should arise. The company started its present fiscal year with a deficit, but business is gradually improving, and even if at the end of the present fiscal year there should still be a deficit, it is not expected that it will be so large that it cannot be overcome in the following year without having resort to fare increases.

Eight Cents in Northport.—The Northport (N. Y.) Traction Company has been authorized by the Public Service Commission, Second District, to increase its rate of fare from 5 to 8 cents, the order to be effective until April 1, 1921, and thereafter until further order of the commission. The company, under authority of the commission, put a 6-cent fare in operation in November, 1917, but after the decision of the Court of Appeals in the Rochester case the company returned to the 5-cent rate. Franchise restrictions by Northport and the town of Huntington were waived. About 200,000 passengers are carried annually and a 3-cent fare increase will result in increased revenue of about $6,000.

Rochester Report Expected Soon.—The railway situation in Rochester, including the amount of the fare, is covered in a report prepared by Public Service Commissioner John A. Barhite, which was filed on April 6 with the Public Service Commission. That body is expected to take action on Judge Barhite's recommendations and suggestions this week. Judge Barhite said that he was not at liberty to divulge the contents of the report. The decision will be announced by the entire commission. Judge Barhite's report covers thirty-six typewritten pages. There is a supplementary report by Electrical Expert Charles R. Barnes, and this report is said to be in full accord with Judge Barhite's recommendations.

Wants More in Macon.—A petition asking an increase in fare from 6 cents to 7 cents has been presented to the City Council of Macon, Ga., by the Macon Railway & Light Company. The company states that unless relief is granted it will be forced into bankruptcy. It declares that the 1-cent fare increase allowed by the Council produced during the year 1919 $81,551 but that the increase in operating expenses consumed the entire additional revenue and $2,591 additional. In the year 1919 the earnings were $491,110 and the operating expenses $398,197, leaving the net income at $92,913. While the gross earnings of the company for the year increased $72,698 the expenses of the transportation department alone increased $84,143.

One Killed in "L" Wreck.—Running by a signal which had been set against it, a local train on the Ninth Avenue "L" line of the Interborough Rapid Transit Company, New York, on April 12 crashed into the rear of a seven-car express, derailing the latter. One of the wooden coaches of the express, catapulted over the side of the "L" structure, was shattered against the brick wall of an office building, its passengers being dumped into the street below. One man in the wrecked coach was so badly injured that he died shortly after the accident. Few of the other passengers were seriously hurt. Traffic on the portion of the Ninth Avenue line below Christopher Street was suspended for more than two hours as a result of the accident.

Personal Mention

Mr. Bleecker Resigns from New Orleans Company

John S. Bleecker, general manager for the receiver, New Orleans Railway & Light Company, New Orleans, La., has resigned to become general manager of the Myles Salt Company, owners and operators of the largest salt mine in the world, which is located near New Orleans. Mr. Bleecker went to New Orleans a little over a year ago from Columbus, Ga., where he was general manager for Stone & Webster of the Columbus Electric Company and Columbus Railroad Company. He undertook a task made difficult by the complications of a receivership, but has made an enviable record during his year with the New Orleans company. In speaking of Mr. Bleecker's resignation, J. D. O'Keefe, receiver, said:

> Mr. Bleecker has severed his connection with the property voluntarily and to my very great regret, as I believe the property is losing an able, conscientious and progressive operating official. Mr. Bleecker came to the property at a critical period in its history and he has done much, during his short tenure, to improve its physical condition and the service generally.

A portrait and a biography of Mr. Bleecker were published in the ELECTRIC RAILWAY JOURNAL at the time he took up his duties in New Orleans.

George I. Plummer has been appointed to the newly created position of superintendent of traffic of the Dallas (Tex.) Railway.

Benjamin B. Foss, for the past twelve years superintendent of the Lynn (Mass.) division of the Eastern Massachusetts Street Railway, has resigned.

Edward H. Sharpe has been appointed general passenger agent of the Pacific Electric Railway, Los Angeles, Cal. Mr. Sharpe succeeds Richard Kelly, who has been made general passenger agent of the Southern Pacific Company.

W. H. McAloney, superintendent of rolling stock of the Winnipeg (Man.) Electric Railway, has resigned. Mr. McAloney, who has been connected with the company for the past two years, will return to Denver, Col. Thirty department heads of the Winnipeg Electric Railway tendered him a farewell dinner on March 31. On that occasion Mr. McAloney was presented with a handsome wrist watch as a token of remembrance from his many friends in Winnipeg.

Samuel Anderson, who filled the position of manager of the electric railways at Norwich and New London, Conn., during the period of their operation by the Connecticut Company, has again taken up the direction of the affairs of the lines. For some time past the lines have been under lease from the Connecticut Company by the Shore Line Electric Railway, but they have reverted to the Connecticut Company from the Shore Line under court order.

F. H. Behrens has resigned from the business department of the ELECTRIC RAILWAY JOURNAL to join the staff of the Simmons-Boardman Publishing Company, New York, as eastern representative of the *Railway Electrical Engineer*. Mr. Behrens has been connected with the ELECTRIC RAILWAY JOURNAL since October, 1911. He entered the business department, and after spending about four years there was transferred to the editorial department, where he worked on the department "Manufactures and Markets," broadening his knowledge of the business as a whole and extending his acquaintanceship among the manufacturers of and dealers in electric railway equipment. After a year in this work he returned to the business department, where he has been since that time.

Promotions in Chicago Elevated

Reorganization of Personnel Announced—B. J. Fallon, Assistant General Manager—Others Step Up

Five members of the operating personnel of the Chicago (Ill.) Elevated Railways have been advanced to positions of greater responsibility in that organization. Under the new plan, as noted briefly in the ELECTRIC RAILWAY JOURNAL for April 10, Bernard J. Fallon becomes assistant general manager, filling the vacancy caused by the resignation of G. T. Seely several months ago, while Edward J. Blair is made assistant to the president. H. A. Johnson takes Mr. Blair's place as organization engineer. R. N. Wade succeeds Mr. Fallon as engineer maintenance of way, while Adolph H. Daus is appointed superintendent of shops and equipment, succeeding Mr. Johnson.

BERNARD J. FALLON, the new assistant general manager, held, until his recent promotion, the position of engineer maintenance of way. Mr. Fallon has been connected with the elevated railroads in Chicago for nearly thirteen years. He was appointed engineer maintenance of way of the old Metropolitan West Side Elevated Railroad in June, 1907. After two years in this capacity he was made assistant general manager of the same road under Britton I. Budd, then general manager. In 1911, when the several elevated railways of Chicago were consolidated and Mr. Budd became president of the combined system, Mr. Fallon was made engineer maintenance of way with jurisdiction over all roads. His jurisdiction was later extended to include the Chicago, North Shore & Milwaukee Railroad, the operation of which had been taken over by Mr. Budd for the Insull interests.

Mr. Fallon was born on Aug. 10, 1880, at Rutland, Ill. His schooling for his work with the elevated system was gained largely in the steam railroad field. After receiving a B. S. degree from La Salle Institute, Chicago, in 1898, he became a rodman with the Burlington Railroad. During the following eight years he held the positions of assistant engineer, division engineer, and finally engineer of track elevation in Chicago. Since his connection with the elevated system he has served on the American Electric Railway Engineering Association way committee. He is a member and a director of the Chicago Engineers' Club and a member of the Western Society of Engineers.

In his new position Mr. Fallon will have a large share of the responsibility of operating the elevated railways, the fast interurban service between Chicago and Milwaukee and the small street railway properties in Waukegan and Milwaukee.

Edward J. Blair, who becomes assistant to the president, was born in Chicago on Feb. 19, 1883. After completing a course of study at Lewis Institute, Chicago, he went to Cornell, receiving an M. E. degree from that university in 1905. In that year he began work in the Throop Street shops of the Metropolitan Railroad as a night helper. Two months later he was given a day job as pipe fitter foreman, and four months thereafter he went into the engineering department as a draftsman and inspector on track elevation work. In the fall of 1906 he was made a carpenter foreman in the maintenance of way department.

After eight months spent at this work, he was made a storage battery operator in the old Throop Street power house of the Metropolitan. In 1908 he was promoted to the position of engineer of substations and transmission lines, with jurisdiction over the entire distribution system of the company. He was again promoted in 1910, becoming electrical engineer of the Metropolitan lines. Upon the consolidation of the several elevated railroads he was made electrical engineer of the Chicago Elevated Railways.

Commissioned a captain of engineers in 1917, Mr. Blair was stationed at Camp Grant for nearly a year, at the end of which he was sent overseas with the rank of major. He was subsequently promoted to lieutenant-colonel. Upon his return to the Chicago Elevated Railways in August, 1919, he was given the title of organization engineer and the duty of studying operating conditions with a view to recom-

mending improvements in methods. Mr. Blair is well known to members of the American Electric Railway Engineering Association through his connection with several of its committees.



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E. J. BLAIR

He is also a member of the committee on electrolysis of the American Electric Railway Association.

Harry A. Johnson, appointed organization engineer, was formerly superintendent of shops and equipment. Mr. Johnson was born at Ottumwa, Iowa, on Dec. 8, 1884. In 1905, shortly after his graduation from Purdue University with the degree of mechanical engineer, he went to work for the Metropolitan West Side Elevated Railroad, and for several months thereafter was engaged as a night helper in the Throop Street shop, as a field engineer on the Douglas Park extension, and on various other special jobs. He was then assigned to design work on equipment. Through 1906 and part of 1907, in addition to his work in this capacity, he served as an inspector of car construc-



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R. N. WADE

tion and later worked for a time in the transportation department on traffic surveys.

In June, 1907, he was made engineer of car equipment, and in the following year master mechanic of the system. In 1911, his jurisdiction was extended to include the three other elevated railroads of the city. When the Chicago, North Shore & Milwaukee Railroad was taken over, he became consulting mechanical engineer for this road in addition to his duties on the elevated lines. Early in 1917 his title was changed to superintendent of shops and equipment, with jurisdiction over the four elevated roads and the Chicago-Milwaukee interurban line. Mr. Johnson has been a member of the equipment committee of the American Electric Railway Engineering Association since 1915. He is also a member of the executive committee. He is a member of the American Institute of Electrical Engineers and the Western Society of Engineers.

Rex N. Wade, who succeeds Mr. Fallon as engineer maintenance of way and structures, formerly held the position of track engineer. Mr. Wade was born on April 30, 1882, in Brussels, Ont. In 1902 he entered the University



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B. J. FALLON

of Illinois, but left college in the winter of 1903. He then joined the Burlington Railroad as a back flagman with a construction force. He continued with the Burlington for several years in location, construction and maintenance work, becoming assistant division engineer in 1906 and later signal supervisor.

In 1908 he became connected with the Metropolitan West Side Elevated Railroad as assistant engineer maintenance of way. Two years later he became engineer maintenance of way of this road, continuing in this position until the consolidation of the elevated railways in 1911, when he was made track engineer of the combined system. He resigned in November, 1912, to become connected with the Pacific Great Eastern Railroad, which was then engaged in the construction of a line from Vancouver to Fort George, B. C. In 1915, however, he returned to the Chicago Elevated Railways, resuming his position as track engineer.

Adolph H. Daus, appointed superintendent of shops and equipment, has been connected with the shops department for some time as assistant superintendent. Mr. Daus entered the service of the Metropolitan West Side Elevated Railroad in 1898 as an armature winder in the Throop Street shop. In



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H. A. JOHNSON

1902 he was made foreman of the winding department, and in 1906 general foreman of electrical repair at the Throop Street shop. In 1912 he was advanced to general foreman of the shop and in 1913, after the operating consolidation of the city's four elevated systems, he was transferred to the downtown office as assistant to the master mechanic.

Mr. Daus' rise to the responsible position which he now holds is a mark of achievement which is all the more remarkable by reason of the fact that his entire knowledge of electrical equipment has been gained through self-education, his only schooling having been that secured in the grammar schools of Chicago and three years of night school. He is the inventor of the high-tension and the heavy-current, low-voltage, low-frequency methods of



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A. H. DAUS

testing motors for opens, shorts and weak insulation. He is also a joint inventor with H. A. Johnson and E. T. Munger of a safety interlocking device which has been installed on 125 elevated cars in Chicago.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Varnish and Enamel Prices Advance

Turpentine Advances to $3 a Gallon in New York Market Owing to Scarcity

Prices of varnishes and enamels have been increased on an average of from 5 to 10 per cent by several manufacturers. Paint, however, has not advanced.

Stocks of varnishes and enamels are badly broken and it is becoming more and more difficult to make deliveries. Demand in the railway field has been heavier than for many months past and is steadily increasing.

It has not been possible to make satisfactory shipments for a month and unless the transportation difficulties are removed immediately paint and varnish manufacturers will sustain heavy losses.

Turpentine is not to be had in New York owing to the coastwise shipping tie-up. Although quoted at $2.50 per gallon on April 10, turpentine is now $3 to $3.50 per gallon. One large manufacturer who has considerable business in the railway field, on Wednesday purchased a considerable amount at Philadelphia, the price being $3 per gallon f.o.b. at that point. No relief is expected until the shipping strike has been settled, after which the price will immediately drop, probably to $2 per gallon. According to reports, a considerable quantity of turpentine is held in the port of New York but cannot be unloaded. In several instances ships have cleared for Southern ports carrying large cargoes of turpentine which they were unable to discharge here.

Manufacturers Hold Good Stocks of Supplies

Many Able to Continue Production for Two Weeks Without Additional Supplies

Manufacturers of electric railway equipment and supplies for the most part have been plentifully supplied with raw materials. Stocks of finished apparatus, however, are piling up rapidly at the factories, and will cause much inconvenience unless some outgoing transportation can be secured.

At the offices of the General Electric Company it was stated that certain raw material stocks are already low and will give out in spots in ten days to two weeks. In general, however, it was stated, the factory can run along for several weeks. Good storage space is still available. The Westinghouse Electric & Manufacturing Company has plenty of raw materials for some weeks to come, it was stated in New York on Thursday. Finished material is piling up at East Pittsburgh, but it will be several weeks before warehouse space will be filled up to capacity. The company is working on its heavy bookings. Other manufacturers have reported fair amounts of raw materials but are unable to transact much business or even to send needed supplies by express. The combination of the railroad strike and the effective tie-up of express by the express company employees has put a premium on every means of transportation. The rush to the parcel post has so clogged the mails that even first-class mail is being seriously delayed in consequence. Up to this time, numerous railways have been receiving rail bonds and shipments of other supplies in 50-lb. packages.

G. E. Sales for 1919 Show Increase

Sales Billed During 1919 Largest in History of the Company—New Plants Acquired

During the past year the volume of business of the General Electric Company, Schenectady, N. Y., exceeded that of any previous year with the exception of 1917, when a considerable portion of the company's business consisted of orders for ship propulsion and other apparatus placed by the Government.

The value of orders received during 1919 was $237,623,932, compared with $234,134,037 for 1918. Sales billed, however, were $229,979,983, the largest in the history of the company, amounting to $13,164,705 more than in 1918 and $33,053,665 more than in 1917. Total figures for orders received and sales billed for the past three years are as follows:

	Orders Received	Sales Billed
1919	$237,623,932	$229,979,983
1918	234,134,037	216,815,277
1917	246,778,491	196,926,318

During the year $14,462,285 was expended for additional land, buildings, machinery and other equipment. The sum of $7,688,893 was charged against income and general plant reserve, making the net increase in book value for the year of plant and equipment $6,773,392.

GENERAL ELECTRIC INCOME STATEMENT FOR 1919

Net sales billed		$229,979,983
Cost of sales billed, including operating, maintenance and depreciation charges		196,855,683
		$33,124,299
Int. and discount	$1,938,391	
Income from securities	2,887,144	
Sundry revenue	405,384	5,230,920
Net income		$38,355,220
Interest on debentures	$571,685	
Int. and discount on notes payable	1,705,564	2,277,249
		$36,077,970
Federal income and excess profits taxes (estimated)		11,000,000
Profit available for dividends		$25,077,970
8 per cent cash dividends		9,545,469
Net surplus for the year		$15,532,501
Surplus January 1 1919		53,250,661
		$68,783,163
4 per cent dividends payable in stock		4,772,918
Total surplus		$64,010,245

Profits were $25,077,970, equal to 20.8 per cent on $120,557,200 capital stock. In addition to the regular 8 per cent cash dividend which is paid quarterly, a semi-annual dividend of 2 per cent, or a total of 4 per cent, payable in stock at par, was declared on Dec. 1, 1919, by the board of directors. Federal income and excess profits taxes for the year are estimated at $11,000,000. For the sake of convenience, the assets and liabilities of the International General Electric Company are included with the above because of failure to complete all of the transfers, etc., by Dec. 31, 1919.

Owing to the increase in orders, the company has added substantially to its manufacturing capacity, partly by enlarging present plants and in part by purchasing or leasing, with option to purchase, factories already constructed which offer immediate available facilities. The total factory floor space has been increased to 20,681,000 sq.ft., as compared with 19,581,000 sq.ft. in 1918.

Lack of Coal May Force Shut-Downs

Railways Affected by "Outlaw" Strike Must Stop Operating Unless Coal Is Obtained

Lack of coal may force a number of railways to suspend service before the week is out. The Eastern seaboard, generally, is in fair shape, but where railways have had to depend on rail for coal shipments, shortages have appeared. The Mayor of Toledo, Ohio, on Monday ordered the confiscation of coal on the Pennsylvania Railroad tracks and its diversion to the Toledo Railways & Light Company in order to keep the railway in operation. The Columbus (Ohio) Railway, Power & Light Company reported on Tuesday only enough coal to last until this Saturday. Boston Elevated Railway has ten days' coal supply and ten more on the water. Interborough Rapid Transit Company, New York, N. Y., in a statement given

out the first of the week at that time had a normal supply. The Brooklyn (N. Y.) Rapid Transit Company on Thursday reported a six days' supply.

Companies in and about New York City are purchasers of tidewater coal, the supply of which is dependent on rail shipments. On April 15 these companies had on hand coal reserves sufficient for their full requirements for a period of from six days to two weeks. Should the condition continue beyond this time it will be necessary for these companies to establish a priority list of power users and apportion the amount of power available for each class of business.

Reports from different parts of the country indicate that conditions gradually are improving and that the strike is rapidly breaking up. Whether or not movements of freight within the next week will be sufficient to prevent shutdowns, is problemetical at this time, but as has happened previous to this time, embargoes against everything except foodstuffs and coal may be declared in order that coal may be had to keep railways, utilities and manufactures from closing down.

$450,000 Carhouse Fire

Fire which broke out on the night of April 7 in one of the cars of the Winnipeg (Man.) Electric Railway destroyed the Main Street carhouse of the company. The machine shop and the store rooms operated in connection with the carhouse were saved by the fire being confined to the carhouse proper by fire doors between the carhouse proper and the shops and by a fire wall between the carhouse and store rooms. The following cars were entirely destroyed: nineteen passenger cars, four single-truck sweepers, one single-truck line department construction car, and one Electric Railway Improvement bonding machine. In addition to the carhouse and the rolling stock that were destroyed, approximately $50,000 worth of tools, etc., was lost, the principal item being thirty-six General Electric 258 motors which the company had on hand for cars it was rehabilitating. The fire loss is estimated at approximately $450,000. The plant and contents were covered by insurance. The company proposes to rebuild the carhouse and replace the rolling stock immediately. The fire spread so rapidly it was possible only to get one car partly out of the carhouse before the overhead work fell. This car was only partly destroyed.

Gear Association to Meet at Detroit

Standardization in the manufacture of gears is one of the important subjects to be discussed at the fourth annual meeting of the American Gear Manufacturers' Association, which will be held in the Hotel Statler, Detroit, Mich., April 29, 30 and May 1. An entire day of the convention will be devoted to the various angles of this subject, and reports will be given by committees which have had it under consideration for months.

An interesting program has been arranged which will include papers on such subjects as "Gears from a Purchaser's Standpoint" by D. G. Stanbrough; "Routing of Gears and Machine Parts Through the Factory" by J. A. Urquhart, of the Brown & Sharpe Manufacturing Company; "The Science of Manufacturing" by Henry M. Leland; "Problems of the Gear User," "Mill Gearing from the User's Standpoint," and other phases of gear manufacturing. A visit to the plant of the Ford Motor Company will be an interesting event of the convention. The annual banquet will be held on Friday evening, April 30, at which F. W. Sinram, president of the association, will act as toastmaster.

Rolling Stock

Hudson & Manhattan Railroad, New York, N. Y., noted in the Feb. 7 issue of the ELECTRIC RAILWAY JOURNAL as inquiring for subway cars, has placed an order with the American Car & Foundry Company for twenty-five cars similar to the ones now in operation in the Hudson tubes.

Franchises

Pacific Electric Railway, Los Angeles, Cal.—An ordinance has been passed by the Los Angeles City Council granting the Pacific Electric Railway a franchise to build a spur track on Santa Monica Boulevard.

Track and Roadway

Birmingham Railway, Light & Power Company, Birmingham, Ala.—This company will build twelve blocks of track in the business section of Bessemer, Ala. The company will abandon its loop in First St. and will install a new double-track loop.

Eastern Massachusetts Street Railway, Boston, Mass.—The Eastern Massachusetts Street Railway has applied for permission to extend its line in Stafford Road, Fall River, Mass.

Southern Public Utilities Company, Charlotte, N. C.—The Southern Public Utilities Company contemplates an extension of its line in Anderson, S. C.

Trenton & Mercer County Traction Corporation, Trenton, N. J.—This company has started work on an extension of its Trenton Junction line. The work will cost $15,000.

Toronto (Ont.) Civic Railway.—It is planned to build a municipal railway line over the Prince Edward Viaduct, Toronto, at a cost of $168,378.

Montreal (Que.) Tramways. — The Montreal Tramways proposes to build a line on Mt. Royal, Montreal.

Dallas (Tex.) Railway.—The Dallas Railway has begun construction of its Lake Ave. extension out Fairmount St. The extension will cost approximately $22,000.

Dallas (Tex.) Railway.—The Dallas Railway has received permission to expend $10,200 in removing the single track from Colonial Ave. between Lenox and Pear Sts., replacing it with double tracks. The company will also remove the double tracks on State St., near Washington Ave.

Dallas (Tex.) Railway.—The Dallas Railway will shortly begin work on the Seventh St.-King's Highway extension. The line will extend from Seventh and Tyler out Seventh to Edgefield, thence on Edgefield to King's Highway, a distance of a little more than one mile, and will cost approximately $100,000.

Wichita Falls (Tex.) Traction Company.—The Wichita Falls Traction Company will shortly begin the construction of a 5-mile double track line to the Wichita Fair Grounds.

Power Houses, Shops and Buildings

Sacramento Northern Railroad, Sacramento, Cal.—The Sacramento Northern Railroad will build an addition to its warehouse at Durham, Cal., to cost $11,000.

Pacific Electric Railway, Los Angeles, Cal.—The Pacific Electric Railway has received a permit for the construction of a station at San Pedro, Cal. The building will cost approximately $50,000.

Terre Haute, Indianapolis & Eastern Traction Company, Indianapolis, Ind.—Plans are being worked out by the Terre Haute, Indianapolis & Eastern Traction Company, the Union Traction Company of Indiana and other interurban roads entering Indianapolis for the erection of a union freight terminal on Kentucky Ave., Indianapolis. The carrying out of the project would involve an expenditure of $1,000,000.

Winnipeg (Man.) Electric Railway.—Fire destroyed the main carhouse of the Winnipeg Electric Railway on Main St. South, Winnipeg, on April 7. The total loss is placed at $450,000 and is covered by insurance. Nineteen cars, four sweepers and one work car were destroyed.

Northern Ohio Traction & Light Company, Akron, Ohio.—Work on two new carhouses for the Northern Ohio Traction & Light Company was scheduled to begin on April 12. One of them will be located on Fulmer Ave., Akron, and the other on the Canton line, near Massillon. The Akron building will be 70 ft. x 130 ft. and will contain eight tracks of the open pit type. The first floor will be used for washing, inspection and workshop for minor repairs. About 100 cars can be stored, but plans call for an extension next year that will make the capacity 175 cars. The second floor will be used as clubrooms for the men, including a modern recreation room, gymnasium and shower baths. The Massillon house will be 52 ft. x 120 ft., with open pit tracks and storage room for twenty-six cars. It will contain clubrooms, lockers and baths.

Trade Notes

National Carbon Company, San Francisco, Cal., has awarded a contract for an addition to its plant, 175 ft. x 275 ft., to cost about $60,000.

Mitchell Rand Manufacturing Company, New York, N. Y., has elected Joseph H. Lecour treasurer of the company, succeeding in this capacity W. E. G. Mitchell, whose duties as vice-president require all of his attention.

Independent Pneumatic Tool Company, Chicago, Ill., has appointed Fred J. Passino to be assistant manager of the Eastern division with headquarters at 1463 Broadway, New York City. Mr. Passino for many years has covered the Southwest territory for the company.

Electric Storage Battery Company, New York, N. Y., through its manager, F. L. Kellogg, announces that on April 24, 1920, the New York office, which has been located for twenty-two years at 100 Broadway, will be removed to the National Association Building, 23-31 West 43d Street.

Kentucky Switch & Signal Company, Louisville, Ky., has been incorporated by R. V. and L. Cheatham of St. Matthews, W. S. Scoggan of Sanford, Fla., and R. R. Scoggan of Jeffersonville. The company is capitalized at $16,000 and proposes to manufacture appliances for electric and steam railroads.

Wellman-Seaver Morgan Company, Cleveland, Ohio, announces that its manufacturing sales department, which handles the company's sales of rubber equipment and machinery, and which is in charge of L. N. Ridenour, moved on March 31 from the company's Akron office to its general offices at 7000 Central Avenue, Cleveland, Ohio.

Chicago Pneumatic Tool Company recently held a general conference of executives, plant and branch managers and salesmen at its Detroit plant, Second Avenue and Amsterdam Street, on the occasion of the formal opening of a large five-story addition. It was reported that much of the proposed increase in production was already absorbed by orders for future deliveries.

W. H. Smaw, purchasing agent for the Georgia Railway & Power Company, Atlanta, resigned March 1, to become southern sales representative of the Electric Service Supplies Company, Philadelphia, manufacturer and jobber of electrical supplies and street railway specialties. Mr Smaw joined the Georgia company in 1903 as assistant purchasing agent and in 1910 became purchasing agent.

Electric Storage Battery Company, Philadelphia, Pa., has appointed Godfrey H. Atkin as manager of its Western district, covering the sales offices, warehouses, service stations and all departments in Chicago, St. Louis, Kansas City, Minneapolis and Denver, with headquarters in the Marquette Building, Chicago. Taliaferro Milton is in charge of the Chicago office, succeeding Mr. Atkin. Both appointments were effective March 1.

Strauss Bascule Bridge Company, Chicago, Ill., has been appointed engineers to design the bascule span of a joint railway and highway bridge over Inner Harbor at Johnson Street by the city of Victoria, B. C. The cost of the bridge will be borne jointly by the city of Victoria, the provincial government of British Columbia and the Canadian Pacific Railroad Company. Preparation of plans and specifications will begin just as soon as all details regarding the requirements as to length of span, etc., are determined.

Roller-Smith Company, New York, N. Y., has appointed Hammond D. Baker as manager of its Detroit, Mich., office at 1202 Majestic Building. Mr. Baker, a graduate electrical engineer of Alabama Polytechnic Institute, after his discharge from the aviation service of the army, became connected with the United Motors Corporation as technical traveling representative. Later he joined the sales department of the Hoskins Manufacturing Company, Detroit, Mich., from which he resigned to accept the appointment with the Roller-Smith Company.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has appointed George Bailey, manager of the supply division of the Cincinnati district office of the company, to be assistant to manager J. J. Gibson of the supply department at the East Pittsburgh works. T. J. Pace, formerly industrial assistant to manager of supply department, has recently been appointed assistant manager of the supply department of the company. Mr. Pace has been actively identified with the electrical industry along supply lines with Westinghouse and allied interests for about twenty years.

National Conduit & Cable Company, Inc., Hastings-on-Hudson, N. Y., has recently opened two new branch offices. Frank T. Payne represents that company and its subsidiary, National Brass and Copper Tube Company, Inc., in the states of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, with headquarters in the Commercial Bank Building, New Orleans, La. Wallace M. Cutler, whose territory covers Ohio, a portion of Michigan and the states of Kentucky and Tennessee, has opened an office in the Hippodrome Building, Cleveland, Ohio.

J. H. Williams & Co., Brooklyn, N. Y., and **Whitman & Barnes Manufacturing Company, Akron, Ohio**, have called a meeting for the merging of the Chicago, Ill., and St. Catherines, Ontario, plants of the latter company with the J. H. Williams Company. This plan will contemplate the operation by J. H. Williams & Co. of drop forging and drop forged tool plants at Brooklyn, N. Y.; Buffalo, N. Y., and West Pullman, Ill., in the United States and at St. Catherines, Ontario, in Canada, which is located close to Buffalo, and the business will be operated by the individuals now connected with these plants. The Whitman & Barnes Manufacturing Company's Chicago plant includes the new forge shop, 100 x 500 ft., and power house, which has just been built by Stone & Webster at a cost, including complete equipment, of $1,250,000. The company will continue the manufacture of twist drills, reamers, etc., at Akron, Ohio.

New Advertising Literature

Monitor Controller Company, Baltimore, Md.: Bulletin 100, on the Monitor system of machine tool control.

E. B. Badger & Sons Company, Boston, Mass.: Bulletins Nos. 100 and 102, describing methods of cooling water and air by the spray system.

Standard Underground Cable Company, Pittsburgh, Pa.: Bulletin No. 100-1, describing its products, copper, brass tubes, rods and wires. Additional data is included.

Lapp Insulator Company, Le Roy, N. Y.: Bulletin No. 62, comparing designs of American and European high-voltage pin-type porcelain insulators. Curves are included.

Smooth-On Manufacturing Company, Jersey City, N. J.: A new thirty-one page booklet, entitled "Smooth-On Home Repairs," describing methods for the repair of boilers, radiators and furnaces.

International Steel Tie Company, Cleveland, Ohio. A booklet, "Maintenance of Way for Street Railways," in which the organization and methods employed on the work necessary for maintaining the tracks of the Connecticut Company are described.

Utilities Engineering and Accounting Company, Harrisburg, Pa., has opened an office in Harrisburg, Pa., 10 South Second Street, which is in charge of W. C. Rounnel, formerly rate expert for the Public Service Commission of Pennsylvania.

Bridgeport Brass Company, Bridgeport, Conn.: An eighty-page publication, "Seven Centuries of Brass Making," a brief history of the ancient art of brass making and its early and even recent method of production as contrasted with the twentieth century electric furnace process as made by this company. Sixty pages are devoted to modern methods in brass making, illustrating furnaces, showing crucibles and their preparation and also the pouring of molds. Difficulties in brass making, possibilities of the electric furnace, electric brass furnaces, casting shops, phono electric wire, brass and copper tubes, sheet brass, rods and wires are thoroughly covered under separate headings and illustrated with numbers of engravings. Additional chapters on the company's laboratory and research department, on the characteristics of brass and on additions and impurities are illustrated and described.

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Yet *Not One Cent* Has Been Spent for Repairs

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The two units in operation here are driving boiler feed pumps which supply the water for two 500 horsepower boilers operating under 140 pounds head.

One unit is operated at a time, the change being made every two weeks.

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Practically all Terrys sold are still in operation—the first one left our plant sixteen years ago.

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ONE out of every eleven men enrolled for the Alexander Hamilton Institute's Modern Business Course and Service is a technical man.

More than 10,000 such men, including graduates of every leading technical institution, as well as superintendents, foremen, and others whose previous education had been gained in the school of practical experience, have tested the Institute's training in their own experience and proved its value.

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You have only to look around you in business to learn the answer. *Departments of business are headed by technical experts; but businesses are headed by men who have added to their technical training a knowledge of the fundamentals of organization, finance, accounting, sales and administration.*

To add that all-round knowledge of business to the equipment of men is the business of the Institute. Its product is self-confidence and judgment based on a mastery of fundamental principles. Added income follows inevitably, for the demand for such men is always in excess of the supply.

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But the President doubted his capacity to deal with the great variety of business problems with which the position would be confronted.

"Test me," he said to the President. "Send out to your files and bring in questions of the sort I will be expected to handle. For a year I have been fitting myself for an opportunity like this under the guidance of the Alexander Hamilton Institute.

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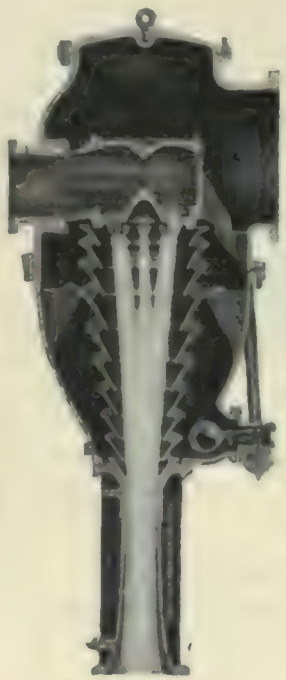
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An advanced combustion system which secures a constant, pre-determined draft at all times, for all rates of combustion, regulating automatically the supply of air required for combustion and the flow of waste gases from the furnaces.

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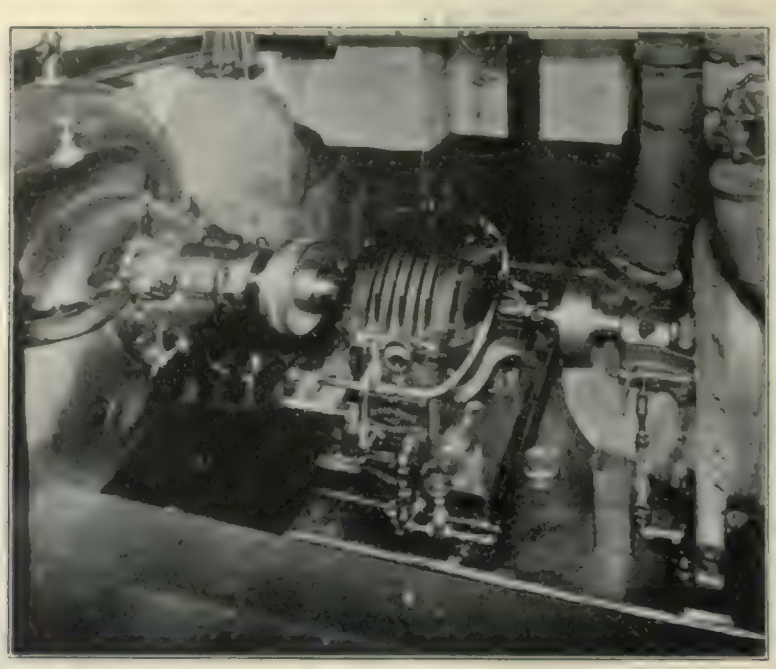
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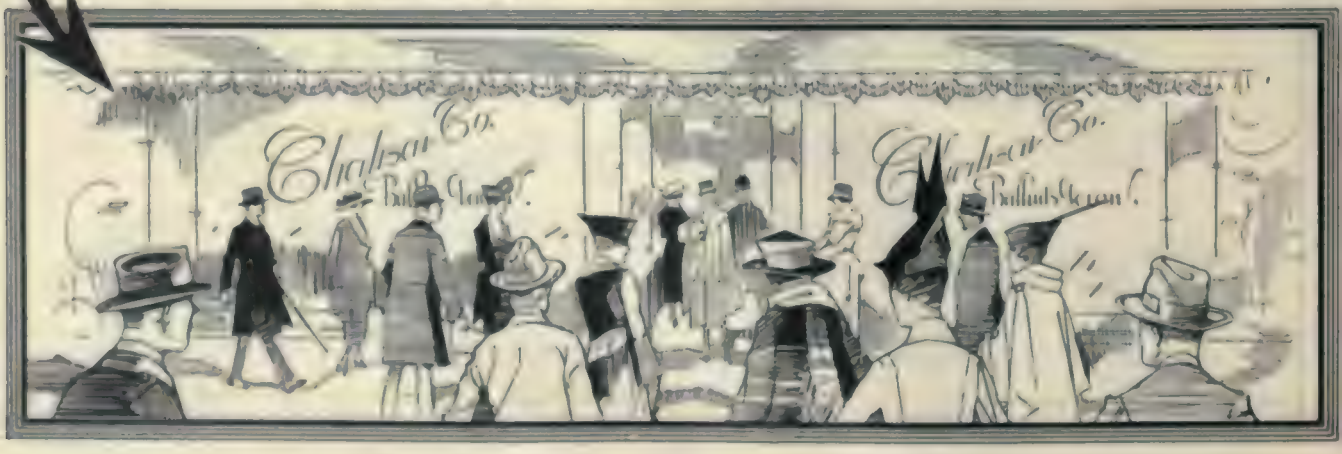
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—that is the record of Berwick Electric Rivet Heaters in daily operation.

The Berwick saves 20 to 70 per cent of operating cost, as compared with fuel-burners.

Reduces burned and scalded rivets to less than ½ of 1 per cent.

Easily moved about. Can be placed close to the work. Often eliminates sticker-boy entirely.

Power used only when hot rivets are needed—less than 20 kilowatt-hours per hundred pounds of rivets heated.

Absolutely Safe—easy to operate—practically no wearing parts or maintenance expense.

Ten types and sizes for various requirements.



No. 3 Two-electrode Berwick Electric Rivet Heater, for ⅝-inch to 1-inch diameter rivets, up to 4½ inches long or longer; capacity 200 per hour. Built also with three or five electrodes.



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Eliminates open fires, smoke, gas, dirt, and intense heat

The Berwick Heater has hot rivets ready in 20 to 30 seconds after starting. No smoke or fumes to hamper the workmen.

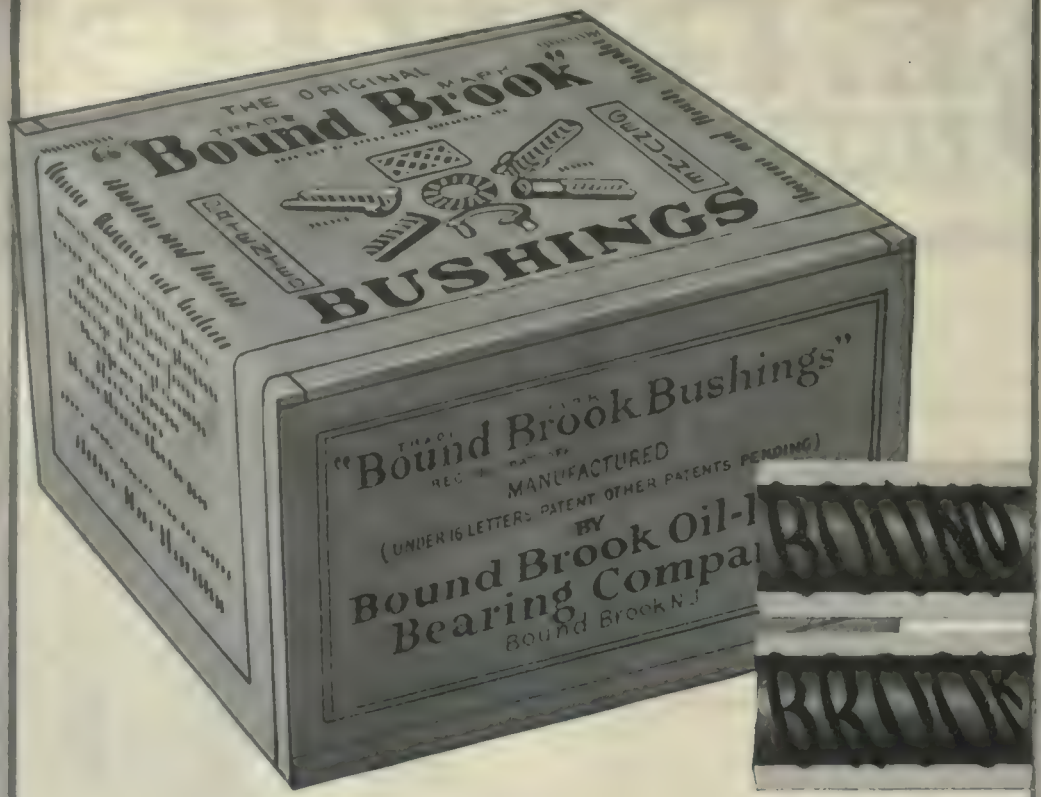
Whether a few rivets only are required, or a steady stream of 2 to 10 per minute, the Berwick is always at instant command. No waste of power; no waiting; no dirt or drippings to be cleaned up.

Berwick Electric Rivet Heaters are long past the experimental stage. More than fifty were in successful operation for years before any were offered for sale.

Send for our new catalogue and read up on this important subject. State your rivet requirements and alternating current conditions.

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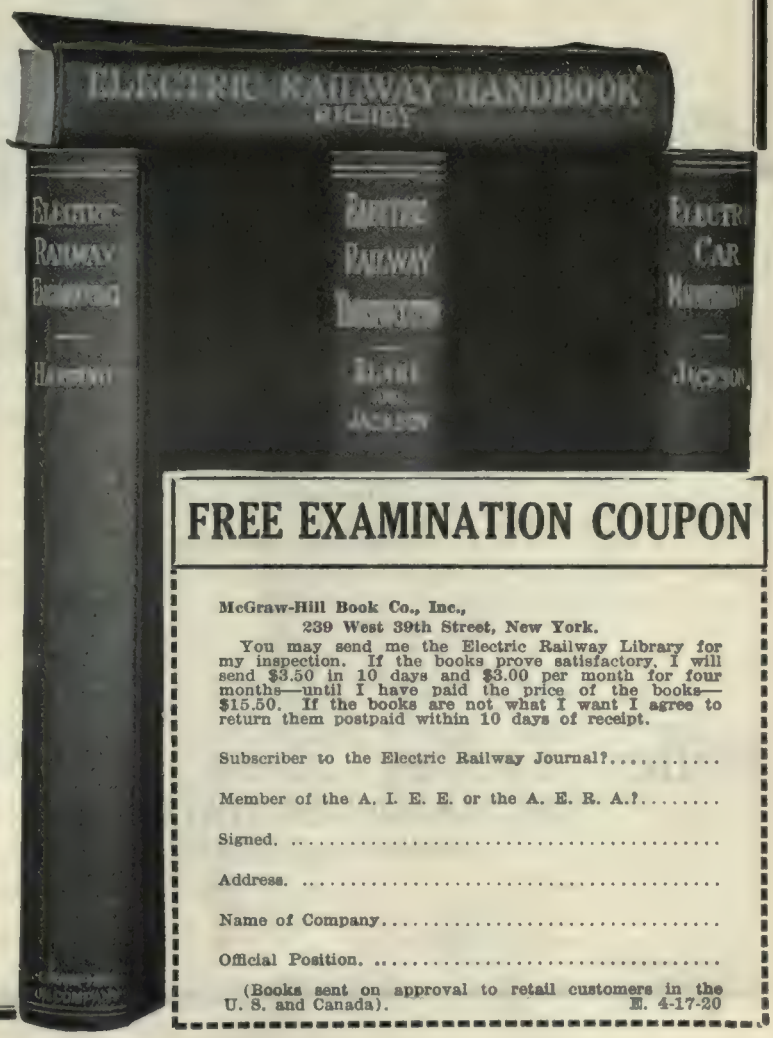
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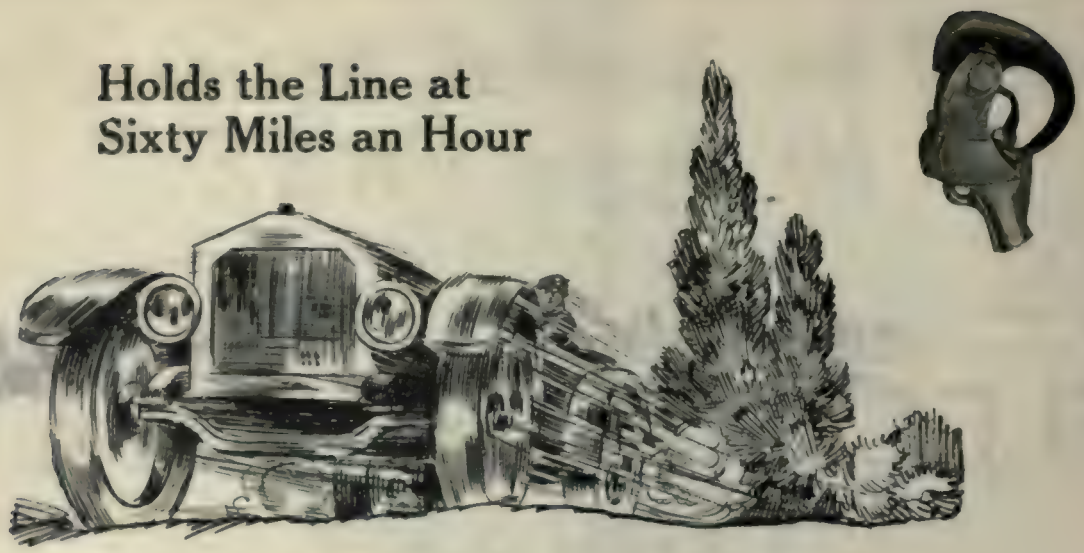
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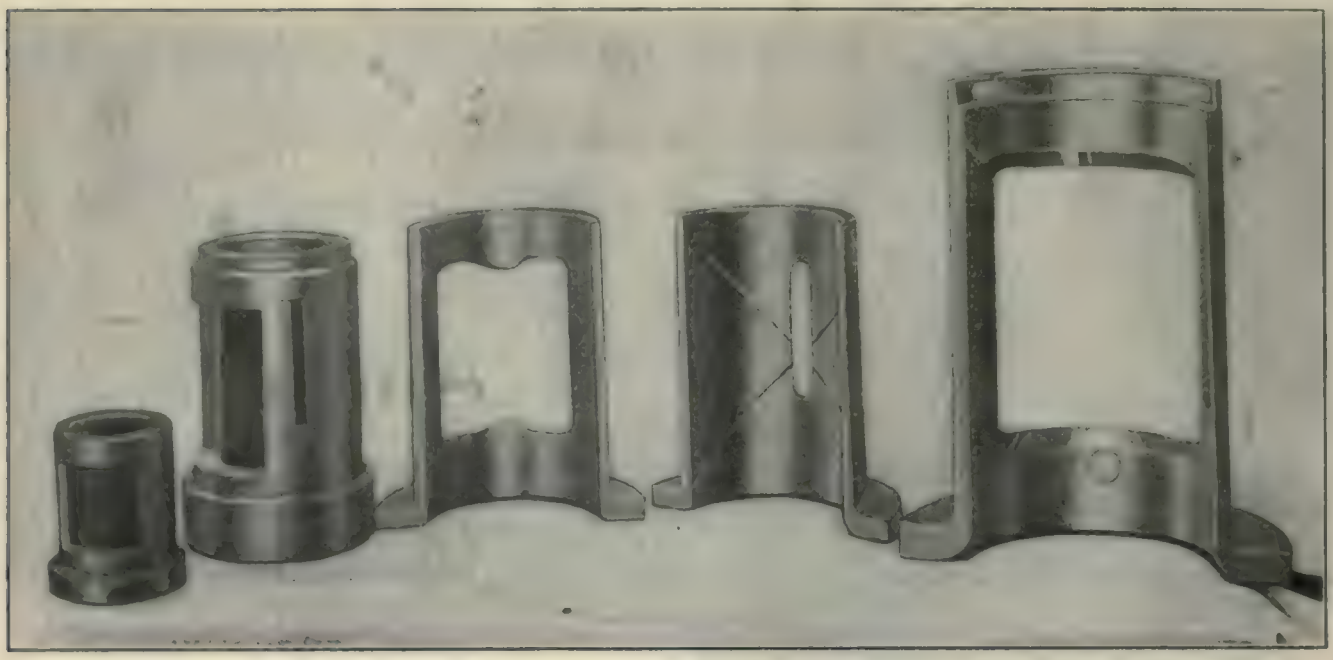
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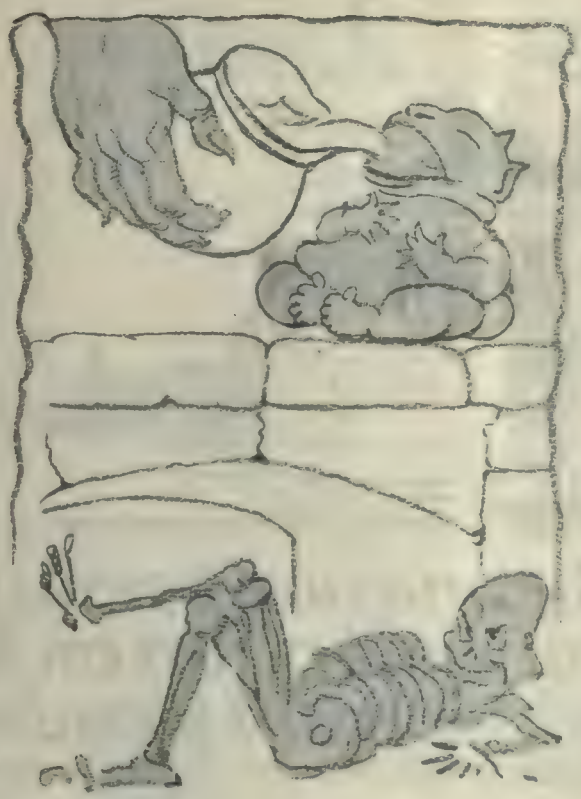
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Amrita

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Good armature bearings cost much less than those of inferior quality. The original purchase price may be a trifle higher, but in the long run they are by far the most economical.

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PITTSBURGH, PA.

Installing Nuttall 15-C Quick-Service car trolley bases. Tempered and tested steel springs keep a good wheel pressure. Bearings minimize friction, making their operation sensitive. Scientific designing has eliminated unnecessary weight and cumbersomeness.

Trolley Wheels with theoretically correct grooves which prevent binding on curves, and graphite bushings which make their revolutions easy and silent.

Helical, BP Treated Gears are the greatest factor that has ever entered into rolling stock propulsion problems. Aside from eliminated noise of gear life, the motors and bearings are protected by the same elimination of vibration.

The quality and nature of the BP treatment is known.

Nuttall Helical Gears

A PROVEN SUCCESS





Slip into his chair for a moment

COME in behind the scenes and sit down in this chair for a moment. It's the editor's chair—*your* editor's chair.

Here on top of the pile of papers is a letter awaiting his signature. It is addressed to one of the foremost engineers in this country and it asks for an article for use in your publication seven months hence. Your editor is thinking *a long way ahead.*

Look at this little note on his memo pad. It reminds him that the cost of white paper has gone up 175%. You see he has *his* production problems, too.

There goes his telephone. Answer it! The secretary of an engineering society is calling to say that your editor has been appointed chairman of a committee to work with the Government on some new industrial plans.

Pick up this inter-office memo. It is from your editor's Washington representative telling about some new bills soon to be presented which have a direct bearing on your profession. What is this note in pencil on the bottom? "Edit." That means he must write an editorial on the subject for the issue nearly ready to go to press.

And here is a leaf from a pocket note book, dated today. It carries a name and address, and the notation: "Should write article for next development issue." A new contributor evidently discovered on the train this morning.

Calendar pads are always interesting. His shows a luncheon engagement with a man whose name is nationally known. Ask your editor's secretary what they'll talk about.

Quite a broad desk your editor occupies! Your McGraw-Hill journal goes to Washington for you; its editors visit big men in every state in the Union, attend your conventions and bring the scattered rays to a true focus for you. You cannot afford to miss a single column of a single issue!

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Coal Age
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McGraw-Hill Co., Inc.
Tenth Avenue at 36th Street
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M-6

OSGOOD BRADLEY

Quantity Production

SAFETY CARS



Osgood Bradley Car Company are pleased to announce that they have perfected their facilities for the design and building of Safety Cars on a quantity production basis.

These cars not only embody the now commonplace feature of lightness, but also offer to a superior degree such other essential features as attractiveness in appearance, comfort in riding and durability in service.

The mass production of safety cars by the Osgood Bradley Car Company will assure the sale of safety cars at a reasonable price; and will also assure the delivery of these cars *quickly*, so that their economies can be obtained at once.

Osgood Bradley Safety Cars absolutely imply most careful design, construction, equipment and finish from drafting board to trolley wheel and farebox.

OSGOOD BRADLEY CAR COMPANY

Builders to Two Generations of Electric Railway Men

WORCESTER, MASS.

"STANDARD"

Steel Tires

Steel Tired Wheels

Solid Rolled Steel Wheels

O. H. Steel and Malleable Iron Castings

Solid Forged Gear Blanks

Steel Forgings Iron Forgings

Forged and Rolled Steel

Pipe Flanges

Ring Dies

Rings

Roll Shells Steel Springs



"The 'Standard' Brand on your material is an assurance of eventual economy."



STANDARD STEEL WORKS CO.

GENERAL OFFICES:

500 NORTH BROAD ST., PHILADELPHIA, PA.

CHICAGO
ST. LOUIS
HAVANA, CUBA

RICHMOND
SAN FRANCISCO
NEW YORK
MONTEREY, MEX.

MEXICO CITY
LONDON, ENGLAND
PARIS, FRANCE

Clear Through The Block

The "GoAhead" Signal is now up for your order. No waiting now for the block is clear.

The order comes direct from you to us. By us we mean the St. Louis Car Co., St. Louis, Mo. That is the only name and address you have to bear in mind when ordering your Supply Parts and One Man Light Weight Safeties. Get it? Direct that order direct to us.

St. Louis Car Co.

St. Louis, Mo.

"The Birthplace of the Safety Car"

SPECIFY THIS MARK

S C M A

TRADE MARK REG. U.S. PAT. OFFICE

ON EVERY TIMBER, BOARD AND BUNDLE of CYPRESS, "The Wood Eternal."

It is your insurance of true

REPLACEMENT ECONOMY

IT'S THE CONSTANT "LITTLE REPAIRS" THAT BUILD UP EXCESSIVE MAINTENANCE COSTS.

Check up on the cost of the work being done on your line—not the big replacements and new construction work—but just the little jobs—replacing a few rotted cross-arms or a few decayed ties, or a bit of fencing, and you will probably be surprised to find how much these items total in the course of a year.

Of course you can never get away from all of this sort of expense, but you can eliminate a surprisingly heavy proportion of it by using

CYPRESS

"THE WOOD ETERNAL"

not only on new construction, but on all replacement work.

All-heart Cypress comes nearest

to being "decay proof" of any lumber in the market suitable for railway use.

Several of the largest railway companies in the country have found the use of Cypress a paying investment.

The data that substantiates this fact will be promptly furnished, if you ask for them.

Southern Cypress Mfrs.' Assn.

1265 Hibernia Bank Building
New Orleans, La.

or

1265 Heard National Bank Building
Jacksonville, Fla.

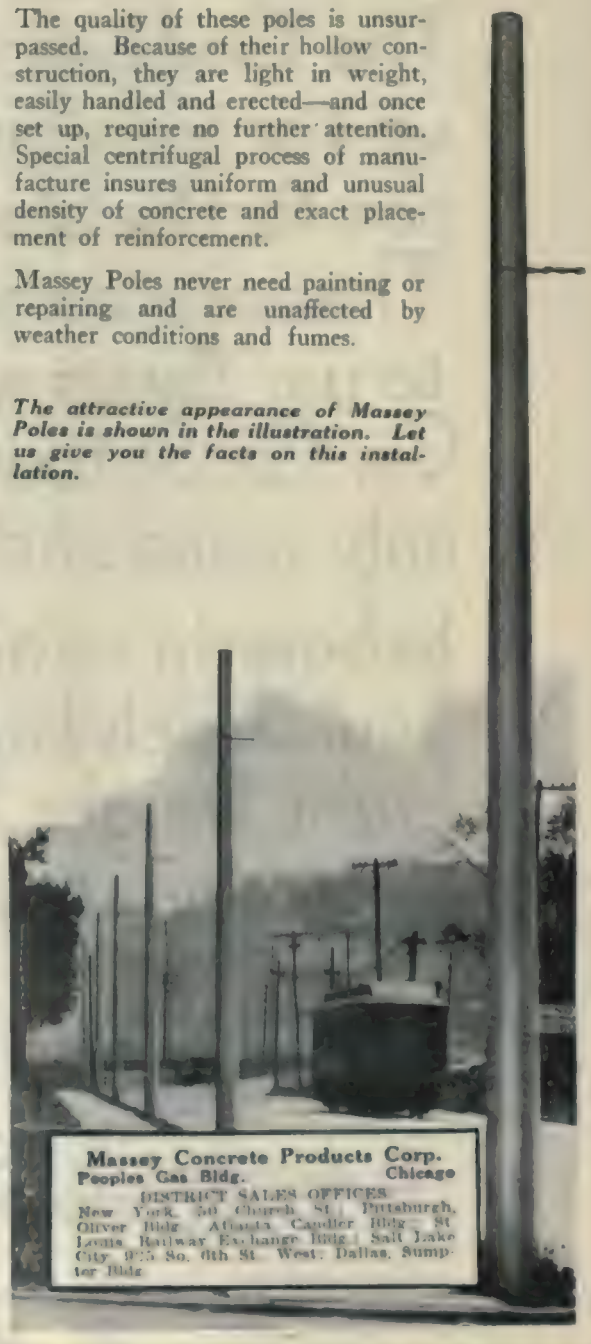
Here's a Pole That You Can Buy TODAY!

You may be meeting the same difficulties as many other railroad executives in securing satisfactory Trolley Poles. Your problem can be solved by using Massey Reinforced Concrete Poles.

The quality of these poles is unsurpassed. Because of their hollow construction, they are light in weight, easily handled and erected—and once set up, require no further attention. Special centrifugal process of manufacture insures uniform and unusual density of concrete and exact placement of reinforcement.

Massey Poles never need painting or repairing and are unaffected by weather conditions and fumes.

The attractive appearance of Massey Poles is shown in the illustration. Let us give you the facts on this installation.



Massey Concrete Products Corp.
Peoples Gas Bldg. Chicago
DISTRICT SALES OFFICES
New York, 50 Church St.; Pittsburgh, Oliver Bldg.; Atlanta, Candler Bldg.; St. Louis, Railway Exchange Bldg.; Salt Lake City, 275 So. 6th St. West; Dallas, Sumpter Bldg.



Colonial Copper Clad Steel Wire

TRADE C.C.C. MARK

Combines the Strength of Steel with the Conductivity and Rust-Resistance of Copper

WHEREVER Strength rather than high conductivity is the determining factor, as in many cases of long distance power transmission, C.C.C. Wire can be used with great economy in installation and maintenance cost. C.C.C. Wire is the result of over 10 years' continuous and successful manufacturing experience during which time millions of pounds of it have been repeatedly sold to some of the largest and most careful buyers in this country. For manufacturing details and comparisons with hard drawn copper wire write our nearest office for Bulletin No. 202.

Standard Underground Cable Co.

Pittsburgh, Pa.

Boston Washington Chicago Seattle New York Atlanta
Detroit Los Angeles Philadelphia Pittsburgh St. Louis Salt Lake City
San Francisco

For Canada: Standard Underground Cable Co. of Canada, Limited, Hamilton, Ont.

MAKE YOUR PARK PAY

Your biggest Park expense can be greatly reduced

A WELTE ORCHESTRION

Supplying the Music Insures Your Success

Our

Automatic Brass Bands

provide just as good music as any full band and our

Dance Hall Instruments

offer the services of a complete orchestra.

Will save their cost in one season

Morning and afternoon attractions now possible—without extra cost.

Dealing with the Welte firm you eliminate experiments.

Write to us for particulars and booklets

M. WELTE & SONS, INC.

(Orchestrion Department)

665, 667 and 669 Fifth Avenue

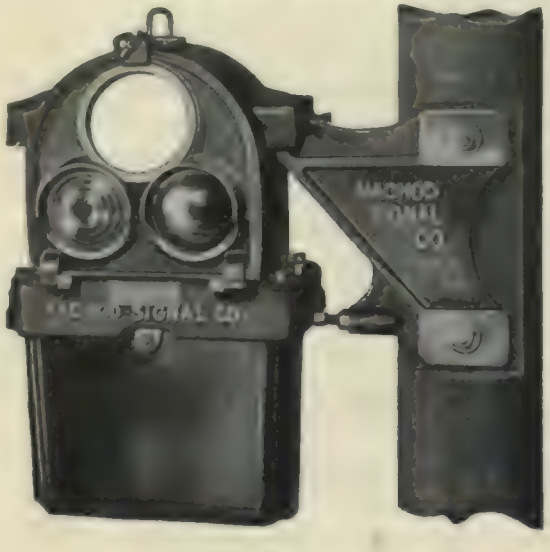
Bet. 52nd and 53rd Streets
New York City



A WELTE ORCHESTRION, as seen in the balcony, supplies the music for this large dance hall—278 x 168 ft.

1,200,000 Movements

Without Failure



In a test on a block of Type CD

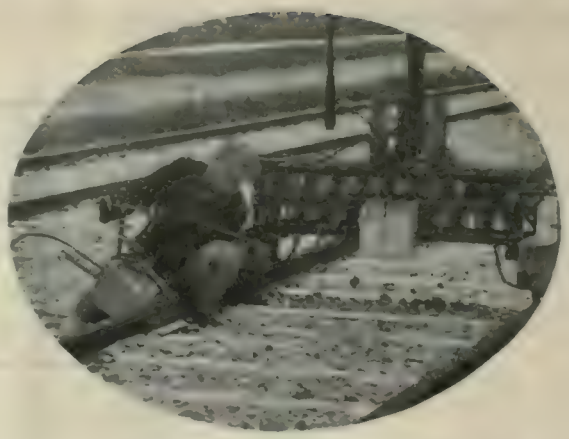
NACHOD AUTOMATIC SIGNALS

by a motor-driven sign flasher, the Veeder counter on the signal registered 1,200,000 signal movements. This accelerated endurance test duplicated the wear on the signals due to a service use of 16 years at an average of 100 cars per day. The signals had not failed in any manner, and at the end of the test they were taken down and examined most minutely for wear. All that could be discovered was a polishing of the parts, the signals being in first-class shape in every way. Would you have expected anything else under the conditions, since the single feature of the immersion of the working parts under oil lubricates them and prevents burning at the electrical contacts?

But this is only one of the reasons why NACHOD SPELLS SAFETY. Let us explain to you how NACHOD SIGNALS can serve you.

Send for Catalog 719

Nachod Signal Co., Inc.
Louisville, Ky.



Half the gang!

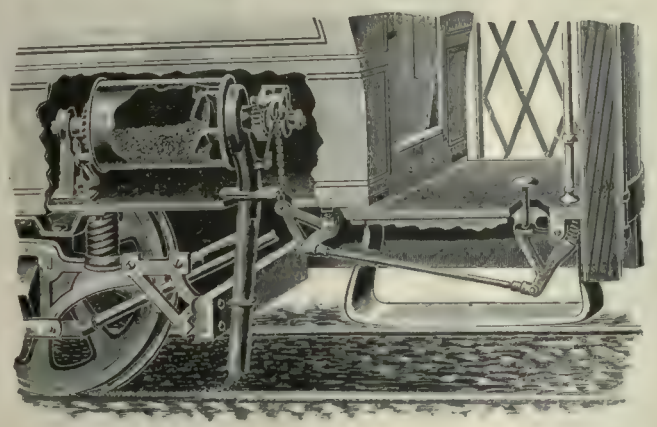
THIS picture shows half of the gang required to operate the Erico Portable Rail Bonding Apparatus. He does the welding. The other half does the preliminary grinding and cleaning.

Between them they can easily average 100 Bonds per day of eight hours when bonding consecutive joints. That's what we mean by *low cost* bonding. Write today for complete data on the Erico—the machine that makes it possible.

***The* ELECTRIC RAILWAY IMPROVEMENT CO.**
CLEVELAND, OHIO

ERICO
PORTABLE RAIL BONDING APPARATUS

Sprague Rotary Track Sander



Spring rains bring slippery tracks, and slippery tracks mean accidents unless—

Your cars are equipped with Sprague Rotary Track Sanders.

When the foot plunger goes down sand is deposited on the rail just where it will prove most effective.

The sand cannot pack because of the rotary motion of the chamber.

It cannot clog nor can it leak and enter the bearings.

ALBERT & J. M. ANDERSON MANUFACTURING CO.

289-293 A STREET, BOSTON, MASS., U. S. A.

NEW YORK
135 Broadway

PHILADELPHIA: 429 Real Estate Trust Bldg.
LONDON: E. C.: 48 Milton St.

CHICAGO
105 S. Dearborn St.

Rotary Converters



of any size or voltage

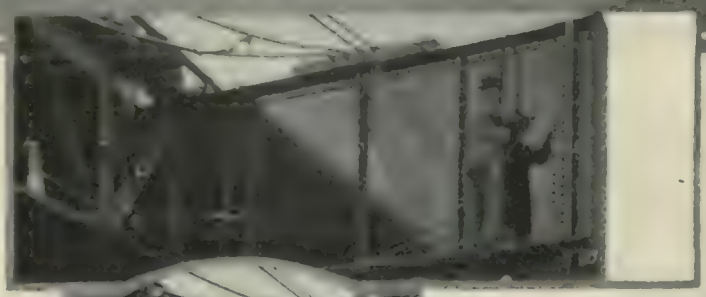
In the installation are shown two 750-kw., 600-volt, 60-cycle Railway Rotary Converters with transformers installed in the power plant of Armour & Company, Stock Yards, Chicago.

Send for new Bulletin No. 1107-A

ALLIS-CHALMERS MFG. CO.

MILWAUKEE, WIS. U.S.A.

SPRACO PNEUMATIC PAINTING EQUIPMENT





The Safety of your passengers depends on the weakest spots of your structure.

Handbrushes cannot get into every crevice and cranny; a

SPRACO PAINT GUN WILL

It consequently prevents rust and the deterioration of girder joints and bolted plates.

Besides making for safety, a Spraco Paint Gun, wielded by one handy man, covers more ground than half a dozen painters with hand brushes. ALL the surface is covered, not a spot escapes the Spraco Gun.

ECONOMY—SAFETY

you are interested in both, so send for Bulletin No. 40

Spray Engineering Co., Boston, Mass.

Manufacturers also of Spraco Air Washers, Cooling Ponds, Nozzles for all purposes, Vaughan Flow Meters

SPRAY ENGINEERING CO. BOSTON, MASS.

USG

U. S. G. on a motor or generator brush means that the United States Graphite Company was glad to stamp that brush as its product.

It means that for commutation no better brush can be procured. That that brush will prove itself thoroughly dependable under all service conditions, and greatly increases operating efficiency.

That such a brush will prove a material aid in lowering maintenance costs.

Let us figure on your requirements

THE UNITED STATES GRAPHITE COMPANY

SAGINAW, MICH., U. S. A.



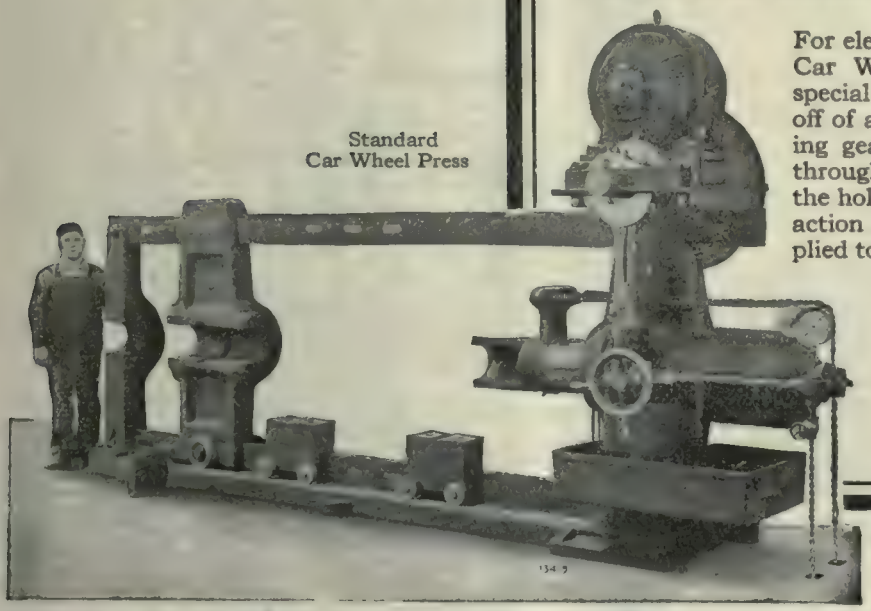
Branch Offices: New York, Chicago, Philadelphia, St. Louis, Pittsburgh, Denver, Birmingham, San Francisco

Largest Miners of Graphite on This Continent



NILES-BEMENT-POND CO.

MACHINE TOOLS



Standard
Car Wheel Press

For electric railway shops, our Standard Car Wheel Press is equipped with a special device for pressing wheels on and off of axles without disturbing the driving gear. The pressure is transmitted through four prongs which pass through the holes in the gear. No spoke bending action results, since the pressure is applied to the hub direct.

In addition to Wheel Presses, Wheel Lathes, Axle Lathes, Tire Mills and other special railway machinery, we build general machines such as Lathes, Planers, Boring and Drilling Machines, Shapers, Slotters, Milling Machines, etc. as well as Steam Hammers and Cranes.

Circulars covering any unit desired await your request.

105

Old or New Cars Made Safer by
Edwards Compression Brake Devices



Fig. 1.

When windows become loose, then there is danger of personal injury, damage to frame, glass and sash lock.

To prevent this and eliminate the rattling of loose windows, there is nothing better than Edwards Compression Brake Devices.

The two springs are of different strengths, the stronger at the top. When window is opened the lower spring is compressed, as in Fig. 2, preventing all rattle. In lowering the sash the shoe automatically slides to the top and compresses the heavier spring, as in Fig. 1, which in turn prevents the sash from falling due to increased friction.

Electric Railways already know what these devices can do and we will show *you*.

Send for information and samples.



Fig. 2.

The O. M. Edwards Co., Inc. Syracuse, N. Y.

Window Fixtures
Top, Bottom and Side Weather Stripping
Metal Top Casings
Metal Extension Platform Trap Doors
All-Metal Sash Balances
Railway Devices

Edwards fixtures are standard on BIRNEY standard safety cars.

Louisiana

684 Elec. Ry. Cars in La.
of which

663 are controlled by Co's.
which regularly use

"Tool Steel" gears & pinions

$\frac{663}{684} = 96.0\%$

Watch for your state!

CRESCENT BELT FASTENERS MAKE GOOD BELTS GIVE BETTER SERVICE

They sustain the belt's full strength

— the more prominent belting manufacturers recommend Crescent Belt Fasteners as the strongest, safest, most durable and most economical method for joining power transmission, elevating and conveying belting of every length width and thickness.

There's a Crescent booster near you. Write and we'll send you his name.

"They make good Belts give better SERVICE"

— Write to — CRESCENT BELT FASTENER CO.

Write to our Electrical Service Dept. for full information how Crescents will help you

381 FOURTH AVE., NEW YORK

— or ask your local dealer

We Specialize So That You Shall Standardize on the

EARLL

Because we have devoted our years of experience to the manufacture of Trolley Catchers and Retrievers exclusively—the only concern in America which has—we are able to produce the kind of catchers and retrievers that will satisfy your demands of service and maintenance.

Many roads all over the country have not used any other catcher or retriever since they installed the first EARLL on their cars.

We will gladly send you samples to try out in actual service if you will describe your equipment, speed, trolley tension, etc. No cost—no obligations.

C. I. EARLL, YORK, PA.



Controller Contact Fingers of Eureka Quality



The Fingers are made of hard-drawn or drop forged copper. Finger springs are of our special alloyed rolled sheet phosphor bronze. In design these fingers are an exact duplicate and interchangeable with original manufacturer's parts and apparatus. Eureka Quality means perfection in workmanship and durability of materials.



NORTH EAST, PA.

The Eureka Co.

Power greater than the amount now generated by America's mightiest waterfall flows through the hundreds of thousands of

Triggerlock Controller Fingers

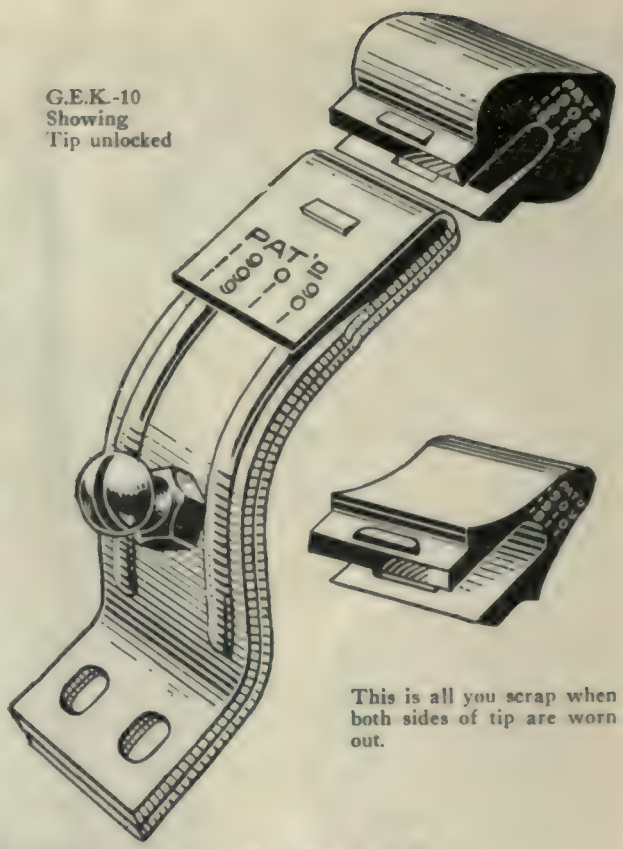
in actual service each day.

They are standard on over 300 Electric Railways. Made within sound of the soft thunder of **Niagara Falls**, they have rapidly won themselves a place wherever they have been tried, and have been faithful aids during the present period of stress.

While the assured economy of the reversible and interchangeable tip is apparent, it is only in actual service that their full value is appreciated. We make fingers for all types of controllers, starters, trucks, compensators, etc., which are perfected in every possible way.

Write for our new catalogue

Note change of firm name



G.E.K.-10 Showing Tip unlocked

This is all you scrap when both sides of tip are worn out.

RUSSELL MANUFACTURING COMPANY

814-18 Bath Ave., Niagara Falls, N. Y. **557 King St., West, Toronto, Canada**

---

10 Seconds

BAYONET EQUIPMENT



High Speed Schedules demand quick but secure repairs on the road.

Bayonet Trolley Harps and Wheels can be changed in 10 seconds without tools. A pole fitted to a Bayonet Base can be changed in one minute by use of Bayonet clamps.

Rugged, perfectly fashioned and serviceable, this detachable feature impairs their durability in no way.

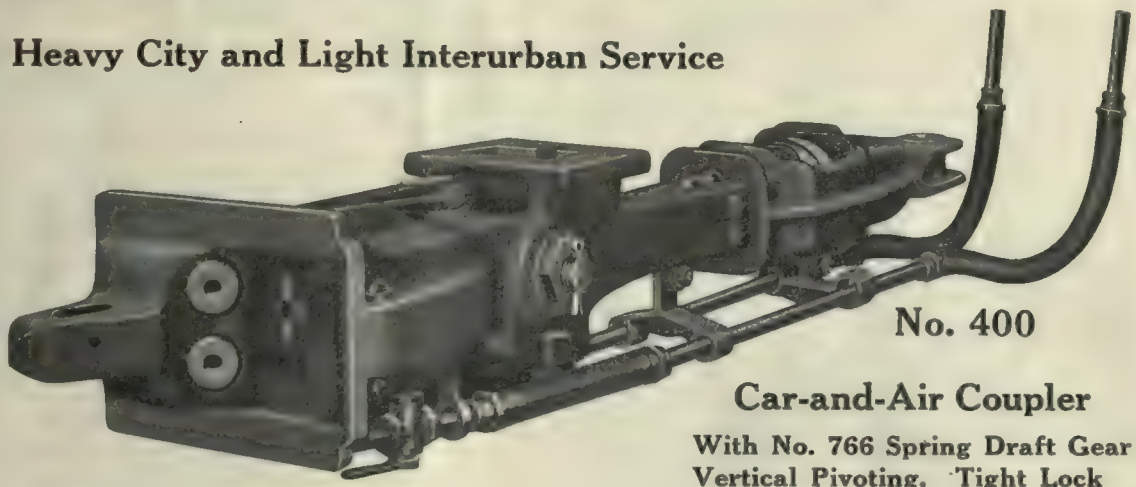


BAYONET TROLLEY HARP COMPANY

Springfield, Ohio, U. S. A.

Van Dorn Car-and-Air Couplers

For Heavy City and Light Interurban Service



No. 400

Car-and-Air Coupler

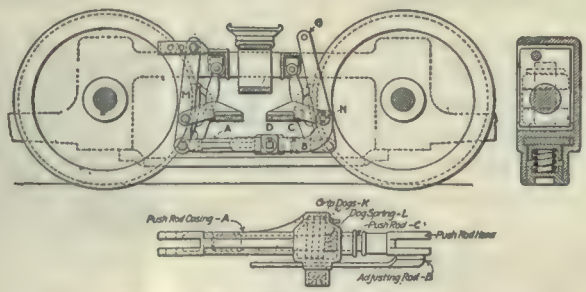
With No. 766 Spring Draft Gear
Vertical Pivoting. Tight Lock

Couples car and air connections automatically by impact. Unlocked by easily accessible unlock levers. Vertical Pivoting Heads relieve platform strains at sharp changes in grade.

Couples positively **Radial movement 120°**

Van Dorn Coupler Company, 2325 S. Pauline St., Chicago, Ill.

GOULD SLACK ADJUSTERS



DETAILS OF THE GOULD TYPE SLACK ADJUSTER AS APPLIED TO AN ELECTRIC CAR TRUCK

Assure Safety at All Times in Braking

A predetermined piston travel is always maintained. The motorman is assured the same braking power at all times.

Economy is another feature which should not be overlooked. All manual adjustment of brakes is done away with, less power consumed in car operation and a great saving in the wear and tear of the complete car equipment is effected.

Gould Slack Adjusters pay for themselves in a very short time.

GOULD COUPLER COMPANY

30 East 42nd Street, New York ***Works: Depew, N. Y.*** **Rookery Bldg., Chicago**

Western Electric
Railway Telephones



Telephone dispatching means better management. It cuts platform expense, improves headway, localizes blockades and offers many other advantages over old methods.

Western Electric Telephones are the telephones to use because they are of highest quality and are made to stand up under unusual service.

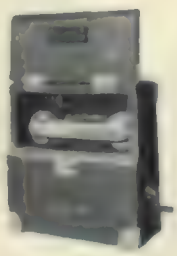
The photographs shown below suggest but a few of the many uses of Western Electric telephones in railway operation.



No. 1278-A

For Dispatching

A weatherproof iron-box telephone designed to fasten to the poles along the line. It is convenient and is the most efficient instrument for dispatching.



No. 1331-E

For Emergency Use

A portable telephone carried in the car for use in case of emergency. The conductor connects it to the wires along the line, thus establishing instant communication.

Our telephone engineers are at your service for consultation in regard to your dispatching problems. Write our nearest house.

Western Electric Company
INCORPORATED
Offices in All Principal Cities



"NEVER-CREEP"

First Cost is Last Cost

THERE'S no upkeep cost connected with the NEVER-CREEP—its installation doesn't mean an annual "repair" expense.

When the NEVER-CREEP is buried, its cost ceases.

Unlike ordinary anchors, wet weather and seasonable heavy strains do not affect it in the least—it continues to serve you well and good under conditions that would mean havoc to old-fashioned anchors.

The more you know about anchors the quicker you'll recognize NEVER-CREEP as a revolution in its field.

ASK YOUR JOBBER

CHANCE COMPANY
Dept. J **Centralio, Mo.**



TRUCK WITH TOWER IN RUNNING POSITION

This 3-Section
TRENTON TOWER

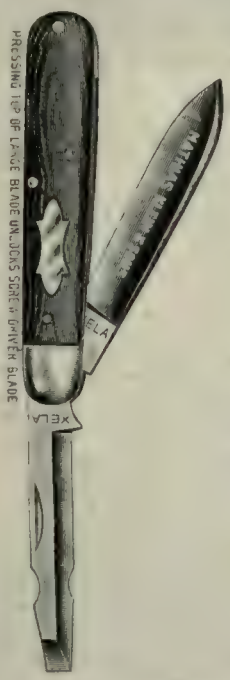
is not only more convenient, but stronger than the older type.

The top section is reinforced by the intermediate section. The 3-section design makes it possible to raise the platform 16 inches higher and drop it 12 inches lower than can be done with the old-style 2-section tower.

We'll gladly send you details.

J. R. McCARDELL CO.
Trenton, New Jersey, U. S. A.

USEFUL
ELECTRICIANS' KNIFE



A handy combination for the electrician, combining an emergency screw driver, a knife blade for cutting or stripping wire; locked so that it cannot close during use. The commendable features are a well-tempered blade, a strong joint, a solid well-proportioned hand-fitting handle and a lock to keep the blade securely open, yet promptly releasable when it is desired to close the blades. Screw driver blade is locked when open; to unlock, press down on large blade.

Mathias Klein & Sons
Canal Station 25, Chicago

STEEL POLES FOR EVERY POLE PURPOSE



Cut shows Bates Steel Poles in use by the Royal Swedish States Rys., electrifying the steam railroads of Sweden, Lapland, located about 75 miles north of the Arctic Circle, in the land of the Midnight Sun, the most northerly railroad of the world.

Bates Steel Poles are becoming universally popular world wide. Repeat orders testify their general suitability for every Pole purpose.

Telegraph, Telephone, Power Transmission, Electric Trolley Lines, Electric Lighting, Etc.

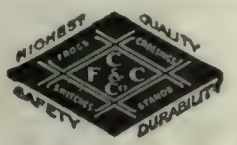
Highest class and most up-to-date steel pole equipment in the world. Our STEEL POLE TREATISE tells the story. Ask for it.

About 2,000 tons of steel constantly on hand; hence prompt shipments.

Tubular Steel Poles cost 50 per cent. more than Bates Steel Poles, yet Bates Poles are 100 per cent. stronger—will last 100 per cent. longer, cover a much broader range of adaptability and are much more artistic than Tubular Poles. Ask us to verify these facts.

BATES EXPANDED STEEL TRUSS COMPANY
208 LaSalle Street Chicago, Ill., U. S. A.

HIGHEST QUALITY
TRACK SPECIAL WORK



WE MAKE THIS GRADE ONLY

CLEVELAND FROG & CROSSING CO.
CLEVELAND, OHIO

HIGH-GRADE TRACK WORK

SWITCHES—MATES—FROGS—CROSSINGS
COMPLETE LAYOUTS
IMPROVED ANTI-KICK BIG-HEEL SWITCHES
HARD CENTER AND MANGANESE CONSTRUCTION

New York Switch & Crossing Co.
Hoboken, N. J.

Dependable Track Work for Electric Railways

ST. LOUIS FROG & SWITCH CO. ST. LOUIS, MO.

Frogs, Switches, Switch Stands, Crossings, Special Track Work, Machine and Drop Forgings, Pressed Steel and Hammer Work. Foundry for Manganese Steel Castings and special facilities for heat treating. Let us bid on your requirements.

ST. LOUIS FROG & SWITCH CO.
ST. LOUIS, MO.

BARBOUR-STOCKWELL CO.

205 Broadway, Cambridgeport, Mass.
Established 1858

Manufacturers of
Special Work for Street Railways

Frogs, Crossings, Switches and Mates
Turnouts and Cross Connections
Kerwin Portable Crossovers
Balkwill Articulated Cast Manganese Crossings

ESTIMATES PROMPTLY FURNISHED

PAGE & HILL POLES
Effectively Butt-Treated



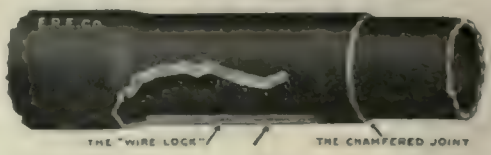
The method of Butt-Treatment used at the Page & Hill plant is the cumulative result of years of work and study. The best results are obtained because each operation has been carefully worked out, and a thorough system is in force which produces Butt-Treated Poles worthy of bearing the mark of quality and endurance—the P & H Brand.

Northern White Cedar Poles, Western Red Cedar Poles, Butt-Treating—the P & H way.

PAGE & HILL CO.

Minneapolis Chicago New York Kansas City
Dallas Houston Louisville

ELRECO TUBULAR POLES



COMBINE
Lowest Cost Lightest Weight
Least Maintenance Greatest Adaptability

Catalog complete with engineering data sent on request.

ELECTRIC RAILWAY EQUIPMENT CO.
CINCINNATI, OHIO
New York City, 30 Church Street

1870 - EUGENE F PHILLIPS - 1882
AMERICAN ELECTRICAL WORKS

WEATHERPROOF WIRE AND CABLE
PAPER INSULATED UNDERGROUND CABLE
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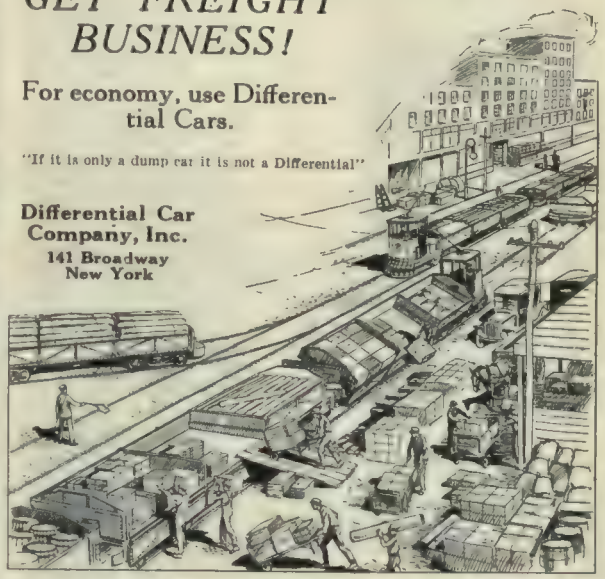
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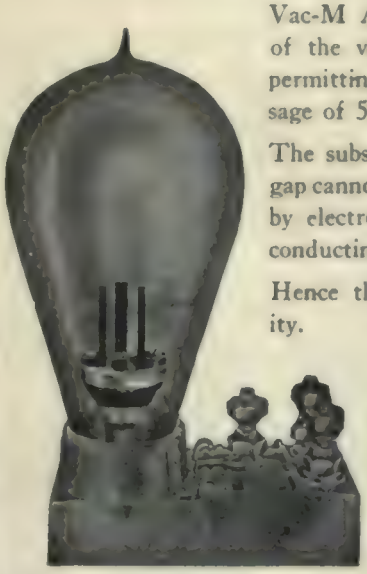
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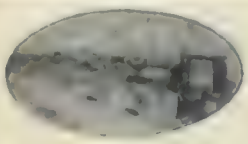
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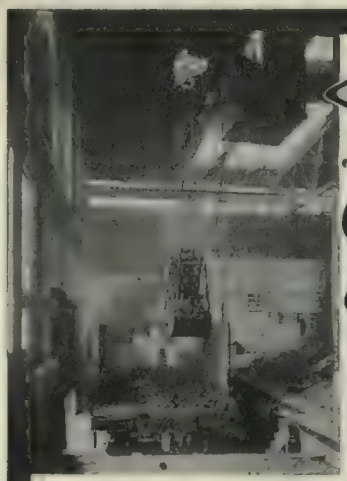


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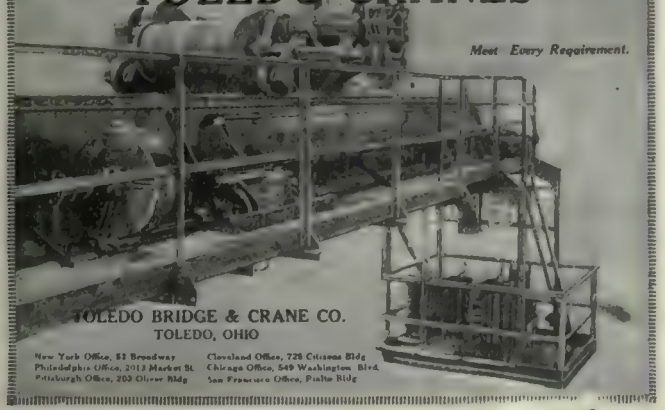
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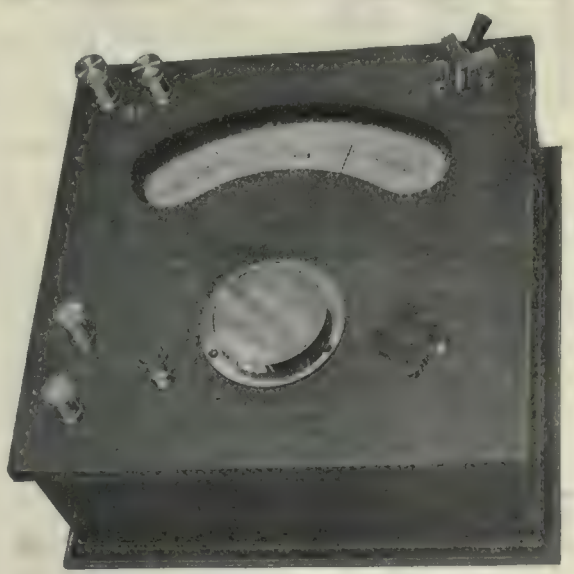
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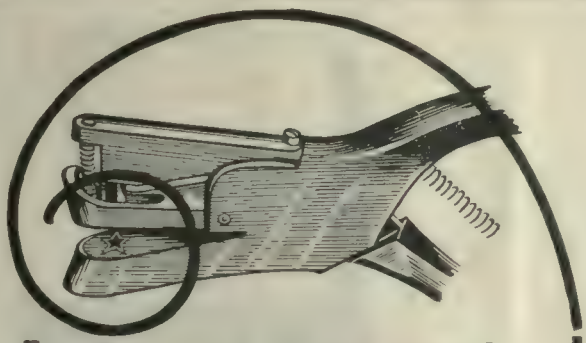
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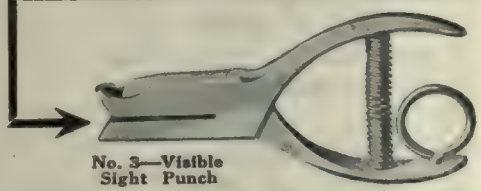


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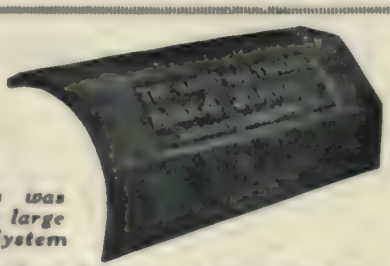
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CHIEF engineer or assistant chief, 8,000 kw. Ohio electric generating plant, tubo and comp. Corliss condensing units; an aggressive man (preferably age 35 or 40), who can handle men, is willing to assume responsibility and who knows combustion and can produce results, is required. Address, P-631, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

A COMPETENT track foreman wanted immediately: Must be experienced in street railway work, including electric welding and track bonding. Give experience, references, photograph, salary desired, and all necessary information in first letter. Galesburg & Kewanee, Electric Railway Company, Kewanee, Illinois.

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ELECTRICAL draftsmen wanted; several, by large construction firm building power stations in Central West. Will pay $1,800 to $2,400 for men with experience in electrical design in connection with power stations, according to ability. Address, giving age, education, experience and salary expected. P-610, Elec. Ry. Journal, Old Colony Bldg., Chicago.

ELECTRICAL engineer wanted, technical graduate with good broad practical experience, electric line maintenance and construction, both A. C. and D. C. as well as experienced power plant operation, a knowledge of street railway construction and operation, is very desirable. Must possess managerial and executive ability as position holds a very good future. In reply give age, experience, references and salary desired. P-620, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

ELECTRICAL engineer wanted, with some experience in street railway work, in city in Middle West. State experience, references, and salary desired when replying. P-605, Elec Ry. Journal, Old Colony Bldg., Chicago.

EXPERIENCED traffic man wanted. Must understand traffic analyses, schedule making, and be able to take full charge of traffic department for large company. Technical man preferred. P-616, Elec. Ry. Journal, Old Colony Bldg., Chicago.

AN experienced car barn foreman wanted for suburban carhouse in a New England town, who is familiar with Westinghouse H-L equipment and General Electric equipment. P-618, Elec. Ry. Journal.

FIRST-CLASS draftsmen wanted, and estimators familiar with steam and electric railway passenger equipment, by large manufacturing concern in the East. P-622, Elec. Ry. Journal.

GENERAL bookkeeper wanted thoroughly experienced in street railway, gas and electric light accounting, and capable of taking charge of the general books of a large public utility company in Middle West. Will pay $200 per month to right man. P-628, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

GENERAL superintendent wanted, experienced in construction and operation of street railway properties as well as lighting and power. Must have good broad experience covering these lines and possess magagerial and executive ability for operating property of about 100 miles street railway and 10,000 light and power consumers. Good future for right person possessing the above qualities. In reply give age, experience, salary desired, when could report for work as well as for interview. P-621, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

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ONE night car barn foreman wanted on Southern property, 100 cars. P-635, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

MAN experienced in direct current wanted, trolley and overhead maintenance and construction work. A knowledge of A. C. maintenance and construction desirable but not essential. Man with broad experience and initiative capable of developing into general foreman wanted. In reply give full particulars of experience, salary desired, when could report for work. P-619, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

POSITIONS WANTED

AUDITOR, broad experience in utility accounting and finance, competent executive. A1 credentials. PW-625, Elec. Ry. Journal.

AUDITOR, specialist for rehabilitating traction properties, solicits connection with large company; reference present employer. PW-629, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

ALLROUND shop man wants position that will be permanent. Have had experience as shop foreman. Address PW-617, Elec. Ry. Journal, Old Colony Bldg., Chicago.

ELECTRICAL engineer; 14 years' experience operating, appraising, testing, estimating, designing; eight years in charge of installation and maintenance of large railway distribution system, including line, conduit and lead covered cable work, desires to locate in the West. PW-632, Elec. Ry. Journal, Old Colony Bldg., Chicago.

EXECUTIVE position by expert operating or transportation man; 15 years' experience in transportation and mechanical departments; also 3 years steam railroad work. Age 35. Will consider any location with future. References A-1. Address 104 N. Third St., Columbus, Ohio. Henry Whisner.

GENERAL superintendent is open for a position; experienced in all branches of street railway work. Can furnish highest reference. PW-633, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

MASTER mechanic desires to make a change; 15 years' experience maintenance and construction; can handle men and get results; A-1 reference from past and present employers. PW-634, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Philadelphia.

MASTER mechanic wishes to make a change; have had 16 years' experience on maintenance and construction in all its branches. At present employed as master mechanic by a road operating from 60 to 70 cars. Can furnish A1 reference from last and present employers. PW-614, Elec. Ry. Journal, 935 Real Estate Trust Bldg., Phila.

POSITIONS WANTED

SUPERINTENDENT age thirty-six, desires change, fourteen years experience in operation and maintenance electric railway and lighting properties; thoroughly familiar with modern, and economical methods. Reference present and past employers. PW-630 Electric Railway Journal 935 Real Estate Trust Bldg., Phila.

AGENTS AND SALESMEN

Manufacturers Attention

Sales representative and engineer, 38 years of age, past 10 years with leading railway supply organization, will establish connection as manufacturer's agent or representative, steam and electric railway supplies on commission basis with salary guarantee; $7,500 minimum. Member of Western Railway Club, Western Society of Engineers, American Institute of Electrical Engineers, Illinois Athletic Club. Twenty years extensive acquaintance, Chicago and Middle West, guarantees capable and efficient representation. Previous executive experience Western district manager. AS-608, Elec. Ry. Journal, Old Colony Bldg., Chicago.

WANTED

Two standard interurban

Passenger Trail Cars

State price and delivery and at what point cars may be inspected. Give full description in first letter.

W636—Electric Railway Journal
1570 Old Colony Bldg., Chicago, Ill.

CARS FOR SALE

2—McKean Gase-Electric Cars.
12—Differential 20-yd. Cars.
5—Gasoline Passenger Cars.
50—Freight Cars.
12—Electric Sets.
Get our List and Prices.
J. F. DONAHOO CO., Birmingham, Ala.

FOR SALE

GIRDER RAILS

100 TONS—80 LBS.—30 FOOT
EXCELLENT CONDITION

DURHAM IRON WORKS
Durham, N. C.

SECOND-HAND GEARS FOR SALE

No		P.	F., In.		Bore, In.	Teeth	
4	W. H. 93 Solid Gears	3	5		4½	63	
3	W. H. 93 Solid Gears	3	5		4-15/32	63	
2	W. H. 93 Solid Gears	3	5		4-7/16	63	
1	W. H. 93 Split Gears	3	5		4½	63	
2	W. H. 101 B Solid Gears	3	5		4½	62	
3	W. H. 101 B Split Gears	3	5		4½	62	New
1	W. H. 101 B Solid Gears	3	5		4-7/16	62	

No.		P.	F., In.		Bore, In.	Teeth	
2	W. H. 56 Split Gears	3	5		4½	58	
5	W. H. 56 Solid Gears	3	5		3¾	58	New
1	G. E. 1000 Solid Gears	3	4½		4	69	New
1	G. E. 80 Split Gears	3	5		4½	69	New
1	Split Gear	3	4½		3¾	67	
1	Solid Gear	3	5		4½	62	
1	Solid Gear	3	5		4-3/16	64	
1	Split Gear	3	5		3-7/32	64	

Several of these gears are new, the others are in excellent condition. Can offer very attractive prices.

NEWPORT NEWS & HAMPTON RAILWAY GAS & ELECTRIC CO.
HAMPTON, VIRGINIA

W. STEWART, *Purchasing Agent*

RAILS IN STOCK

IMMEDIATE SHIPMENT

GUARANTEED

10,000 Tons New 12-lb. to 100-lb., and fastenings.
40,000 Tons New Open-hearth, first quality, 80 lb.
5,000 Tons Relayers, 25 to 100 lb., and fastenings.
Car and less carload inquiries and orders solicited.
Rails cut to lengths for all purposes.

TRACK ACCESSORIES
BOLTS, NUTS AND SPIKES

We Manufacture

FROGS, SWITCHES, CROSSINGS, PORTABLE TRACK, DUMP CARS, PLATFORM CARS, ETC.

L. B. FOSTER COMPANY

Park Building
Pittsburgh, Pa.

Tribune Building, 154 Nassau St.
New York, N. Y.

Machinery in Stock for *Immediate Shipment*

ROTARY CONVERTERS

2—300 kw., Westg., 3-phase, 60-cycle, 370-v., A.C., 575-v., D.C., 600 r.p.m.
2—200 kw., G.E., 3-phase, 25-cycle, 85-v., A.C., 125-v., D.C., 8 pole, 375 r.p.m.
1—150 kw., Westg., 2- or 3-phase, 60-cycle, 185-v., A.C., 250-v., D.C., 720 r.p.m.

FREQUENCY CHANGER SET

1—600 kva., Allis-Chalmers Frequency Changer Set, 300 r.p.m., 3-phase, 60-cycle, 2300-v. one end, 3-phase, 6600-v., 25-cycle on other end.

ARCHER & BALDWIN, INC.
114-118 Liberty Street, New York City
Telephone 4337-4338 Rector

INTERURBAN CAR

IMMEDIATE DELIVERY

CAR BODY—Niles Car Company

Passenger compartment, combined baggage and smoker.	
Length over bumpers	52-ft. 6-in.
Extreme width	9-ft. 0-in.
Height—rail to run. bd.	13-ft. 2-in.
Seating capacity	60

TRUCKS—American Locomotive

Wheel base	6-ft. 10-in.
Truck centers	30-ft. 8-in.
Diam of wheels 36-in.	Axles 6-in.

EQUIPMENT

4—Westinghouse 112B Motors.
2—K 34B Controllers.
CP 27 Air Compressors.
Westinghouse Air Brake.
Peter Smith Hot Water Heater.

L. G. VAN NESS,
1431 Union Trust Bldg., Cincinnati, Ohio.

FOR SALE

TILDEN CAR REPLACERS

15 Pairs new Genuine Tilden No. 3 Car Replacing Frogs for 60 to 85 lb. rail, complete with clamp. Weight per pair 208 lbs.

Attractive price on application

THE J. G. WHITE ENGINEERING CORPORATION
43 Exchange Place, New York

Caution—RAIL USERS

If you contemplate needing more track during 1920, BUY NOW. There will be a SCARCITY. We own and offer the following NEW RAILS for prompt shipment:

New 12-lb. Rails, splices, bolts and nuts.
New 30-lb. Rails, angle bars, bolts and nuts.
70-lb. ASCE Relayers.
New 80-lb. Rails, angle bars, bolts, nuts and spikes.
New 90-lb. Rails, angle bars, bolts, nuts and spikes.

They will be gone soon. Write or wire for our quotations.

HYMAN-MICHAELS COMPANY
531 Peoples Gas Bldg., Chicago

BRANCH OFFICES: First National Bank Bldg., Pittsburgh, Pa.; Railway Exchange Bldg., St. Louis, Mo.; East Chicago, Ind.
YARDS AND WAREHOUSES: East Chicago, Ind. and St. Louis, Mo.

STREET CARS

3—32-ft., 4-ft. 8½ in. ga. closed motor cars; seating capacity 32. Symington-Baldwin trucks. First Class. Will convert to one man operation if desired.
4—32-ft., 4-ft. 8½ in. ga. open trailers; seating capacity 35. Taylor McGuire trucks. Good.

ZELNICKER IN ST. LOUIS

For a list of hundreds of other unusual bargains in Rails, Railway and Industrial Machinery and Equipment write for Our Latest General Bulletin.

WORRYLESS ELECTRICAL REPAIRS

On all kinds and sizes A.C. or D.C. motors and generators, starters, welders, controllers, or anything electrical. Quick shipment from stock material of coils, commutators—shafts—bearings, etc. Remember our initials stand for our product.

CAREFUL CLEVELAND **ACCURATE ARMATURE** **WORRYLESS WORKS, Inc.**

EST. 1895 4732-4-6 ST. CLAIR AVE., CLEVELAND INC. 1918

Electric Railway for Sale!

We have purchased the entire equipment of the Cincinnati & Columbus Traction Co., which was operated from Norwood to Hillsboro, O., a distance of approximately 53 miles, and offer for sale the following:

RAILS—

4000 tons No. 1, 70-lb. relaying steel rails.

WIRE—

500,000 lb. or more of copper trolley, feeder, high tension, etc.

POWER EQUIPMENT—

6—Babcock & Wilcox Boilers, 165-lb. pressure, equipped with American Stokers, forced and induced draft, and economizers.
2—Corliss Engines.
Generators.
Switchboards and Transformers.
2—Rotary Converters.

ROLLING STOCK (Standard Gauge)—

Suitable for Industrials only.
5—Box Cars.
3—Flat Cars.
1—Derrick Car.
5—Gondolas.
3—Gondola Cars, Center Dump.

A number of all steel Bridges for quick acceptance at $1.00 per 100 lbs. as is

Write or wire us, stating just what you are interested in, and we will be pleased to submit quotations and further particulars.

HYMAN-MICHAELS COMPANY

(Refer to Department J)

People's Gas Building, Chicago, Ill.

Branches: New York City—Pittsburgh—St. Louis

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

Advertising, Street Car
Collier, Inc., Barron G.
Air Aftercoolers
Ingersoll-Rand Co.
Air Receivers
Ingersoll-Rand Co.
Ammeters
Weston Elec'l Instrument Co.
Anchors, Guy
Chance Co., The.
Electric Service Supplies Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & M. Co.
Angle Bars
Lackawanna Steel Co.
Ash Storage Tanks, Cast Iron
Green Engineering Company
Automobiles and Buses
Brill Co., The J. G.
Axle Straighteners
Columbia M. W. & M. I. Co.
Axles, Car Wheel
Bemis Car Truck Co.
Brill Co., The J. G.
St. Louis Car Co.
Standard Steel Works Co.
Westinghouse Elec. & M. Co.
Babbitt Metal
Ajax Metal Co.
More-Jones Brass & Metal Co.
Babbitt Metal Holding Compound
Peddinghaus Compound Co.
Babbitting Devices
Columbia M. W. & M. I. Co.
Badges and Buttons
American Railway Supply Co.
Electric Service Supplies Co.
International Register Co., The
Western Electric Co.
Batteries, Dry
National Carbon Co., Inc.
Western Electric Co.
Batteries, Storage
Electric Storage Battery Co.
National Carbon Co., Inc.
Western Electric Co.
Bearings and Bearing Metals
Ajax Metal Co.
Bemis Car Truck Co.
Brady Brass Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
More-Jones Brass & Metal Co.
St. Louis Car Co.
Westinghouse Elec. & M. Co.
Bearings, Center and Roller Side
Stucki Co., A.
Bells and Gongs
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
St. Louis Car Co.
Western Electric Co.
Belt Fasteners
Crescent Belt Fastener Co.
Belt Hooks
Crescent Belt Fastener Co.
Crescent Lacing
Crescent Belt Fastener Co.
Benders, Rail
Niles-Bement-Pond Co.
Western Electric Co.
Zelnicker, Walter A., Supply Co., Inc.
Boilers
Babcock & Wilcox Co.
Boiler Tubes
National Tube Co.
Bond Testers
American Steel & Wire Co.
Roller-Smith Co.
Bonding Apparatus
American Steel & Wire Co.
Electric Railway Improv. Co.
Electric Service Supplies Co.
Ohio Brass Co.
Bonds, Rail
Electric Railway Improv. Co.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & M. Co.
Book Publishers
McGraw-Hill Book Co., Inc.
Boring Tools, Car Wheel
Niles-Bement-Pond Co.
Brackets and Cross Arms. (See also Poles, Ties, Posts, Etc.)
American Bridge Co.
Bates Expanded Steel Truss Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Hubbard & Co.
Lundstedt Bros. Co.
Ohio Brass Co.
Western Electric Co.
Brake Adjusters
Gould Coupler Co.
National Ry. Appliance Co.
Smith Ward Brake Co.
Westinghouse Traction Brake Co.
Brake Shoes
Amer. Brake Shoe & Fdry. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Brakes, Brake Systems and Brake Parts
Ackley Brake & Supply Corp.
Allis-Chalmers Mfg. Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
General Electric Co.
National Brake Co.
St. Louis Car Co.
Safety Car Devices Co.
Westinghouse Traction Brake Co.
Bricks, Fire
Green Engineering Co.
Bridges and Buildings
American Bridge Co.
Brooms, Track, Steel or Rattan
Paxson Co., J. W.
Western Electric Co.
Zelnicker, Walter A., Supply Co., Inc.
Brushes, Carbon
General Electric Co.
Jeandron, W. J.
Morgan Crucible Co.
United States Graphite Co.
Western Electric Co.
Westinghouse Elec. & M. Co.
Brushes, Graphite
United States Graphite Co.
Brush Holders
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.
Flower, D. B.
Buckets
Blaw-Knox Co.
Bunkers, Coal
American Bridge Co.
Bushings, Case Hardened and Manganese
Bemis Car Truck Co.
Bushings, Graphite and Wooden
Bound Brook Oilless Bearing Co.
Bushings, Trolley Wheel
Ives Co., H. B.
Cables. (See Wires and Cables)
Carbon Brushes. (See Brushes, Carbon)
Carbon Projector
National Carbon Co., Inc.
Carbons, Photographic
National Carbon Co., Inc.
Carbons, Welding
National Carbon Co., Inc.
Car Equipment. (For Fenders, Heaters, Registers, Wheels, etc., see those headings)
Car Trimmings. (For Curtains, Registers, Doors, Seats, etc., see those headings)
Car Panel Safety Switches
Westinghouse Elec. & Mfg. Co.
Cars, Dump
Differential Car Co.
Cars, Passenger, Freight, Express, etc.
American Car Co.
Brill Co., The J. G.
Ruhlman Car Co., G. C.
McGuire-Cummings Mfg. Co.
National Ry. Appliance Co.
Osgood-Bradley Car Co.
St. Louis Car Co.
Wason Mfg. Co.
Cars, Second Hand
Electric Equipment Co.
Car, Self-Propelled
Electric Storage Battery Co.
General Electric Co.
Castings, Brass, Composition or Copper
Ajax Metal Company
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.
More-Jones Brass & Metal Co.
Castings, Gray Iron and Steel
American Bridge Co.
American Steel Foundries
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Standard Steel Works Co.
Castings, Malleable and Brass
Amer. Brake Shoe & Fdry. Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Catchers and Retrievers, Trolley
Ford, C. T.
Electric Service Supplies Co.
Ohio Brass Co.
Wood Co., Chas. N.
Caustic Soda Cells
National Carbon Co., Inc.
Checks, Employees'
American Railway Supply Co.
Circuit Breakers
Cutter Electrical & Mfg. Co., The
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Clamps and Connectors for Wires and Cables
Anderson Mfg. Co., A. & J. M.
Dossert & Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hubbard & Co.
Klein & Sons, Mathias
Ohio Brass Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Cleaners and Scrapers—Track (See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.
Ohio Brass Co.
Western Electric Co.
Clusters and Sockets
General Electric Co.
Coal and Ash Handling. (See Conveying and Hoisting Machinery)
Coil Banding and Winding Machines
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Western Electric Co.
Coils, Armature and Field
Cleveland Armature Works
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Westinghouse Elec. & M. Co.
Coils, Choke and Kicking
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & M. Co.
Coin-Counting Machines
Electric Service Supplies Co.
International Register Co., The
Johnson Fare Box Co.
Combustion Systems
Engineer Co., The
Comelong
Bush Electric Co.
Commutator Slotters
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Commutator Truing Devices
General Electric Co.
Commutator or Parts
Cameron Electrical Mfg. Co.
Cleveland Armature Works
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Mica Insulator Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Compressors, Air
Allis-Chalmers Mfg. Co.
Chicago Pneumatic Tool Co.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Trac. Brake Co.
Compressors, Gas
Ingersoll-Rand Co.
Concrete Mixers
Blaw-Knox Co.
Concrete Products
Massey Concrete Products Co.
Condensers
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Conduit Fittings
Chicago Fuse Mfg. Co.
Conduits, Flexible
Tubular Woven Fabric Co.
Conduits, Underground
Western Electric Co.
Connectors, Solderless
Dossert & Co.
Frankel Connector Co.
Westinghouse Elec. & Mfg. Co.
Controller Fingers
Russell Mfg. Co.
Controllers or Parts
Allis-Chalmers Mfg. Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Russell Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Controller Regulators
Elec. Service Supplies Co.
Controlling Systems
General Electric Co.
Westinghouse Elec. & Mfg. Co.
Converters, Rotary
Allis-Chalmers Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Conveyors, Belt
Portable Machinery Co.
Conveyors, Coal and Ash
Green Eng. Co.
Portable Machinery Co.
Conveyors, Portable
Portable Machinery Co.
Conveying and Hoisting Machinery
American Bridge Co.
Columbia M. W. & M. I. Co.
Green Eng. Co.
Portable Machinery Co.
Cooling Systems
Spray Engineering Co.
Copper Wire
Anaconda Copper Mining Co.
Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Roebling's Sons Co., John A.
Samson Cordage Works
Cord Connectors and Couplers
Electric Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.
Couplers, Car
Brill Co., The J. G.
Gould Coupler Co.
Ohio Brass Co.
Van Dorn Coupler Co.
Westinghouse Trac. Brake Co.
Cranes
Allis-Chalmers Mfg. Co.
Niles-Bement-Pond Co.
Toledo Bridge & Crane Co., The
Creosoting. (See Wood Preservatives)
Cross Arms. (See Brackets)
Crossing Foundations
International Steel Tie Co.
Crossing Signals. (See Signals, Crossing)
Crossings, Frog & Switch
Wharton, Jr., & Co., Wm.
Crossings, Track. (See Track, Special Work)
Culvert Pipe, Concrete
Massey Concrete Products Co.
Culverts
Stark Rolling Mill Co.
Curtains and Curtain Fixtures
Brill Co., The J. G.
Du Pont Fabrikoid Co.
Edwards Co., Inc., The O. M.
Electric Service Supplies Co.
St. Louis Car Co.
Cutouts
Chicago Fuse Mfg. Co.
Dealers' Machinery
Archer & Baldwin
Cleveland Armature Works
Electric Equipment Co.
Foster Co., L. B.
Griswold Machine Co., Geo. M.
Hyman Michaels Co.
MacGovern & Co., Inc.
Zelnicker Supply Co., Inc., Walter A.
Derailing Devices. (See also Track Work)
Cleveland Frog & Crossing Co.
Destination Signs
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Western Electric Co.
Detective Service
Wish Service, P. Edward
Dispatching Systems
Western Electric Co.
Dogs, Lathe
Williams & Co., J. H.
Door Operating Devices
Consolidated Car Heating Co.
National Pneumatic Co., Inc.
Safety Car Devices Co.
Doors and Door Fixtures
Brill Co., The J. G.
Edwards Co., Inc., The O. M.
General Electric Co.
Hale & Kilburn Corp.
Doors, Folding Vestibule
National Pneumatic Co., Inc.
Draft Rigging. (See Couplers)
Drills, Rock
Ingersoll-Rand Co.
Drills, Track
American Steel & Wire Co.
Chicago Pneumatic Tool Co.
Electric Service Supplies Co.
Niles-Bement-Pond Co.
Ohio Brass Co.
Drinking Cups, Sanitary Paper
Individual Drinking Cup Co., Inc.
Dryers, Sand
Electric Service Supplies Co.
Zelnicker Supply Co., Inc., Walter A.
Electrical Wires and Cables
Roebling's Sons Co., J. A.
Electrodes
National Carbon Co., Inc.
Engineers, Consulting, Contracting and Operating
Archbold-Brady Co.
Arnold Co., The
Clark Management Corp., E. W.

Now the
ONE-MAN SAFETY CAR
has arrived, start right with

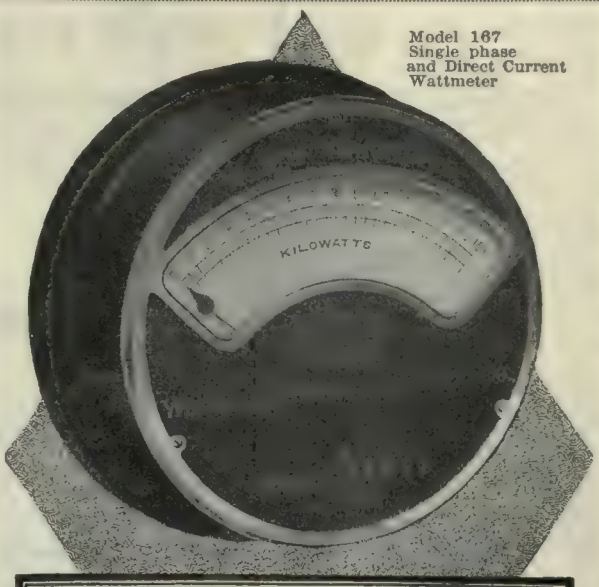
Standard Patterns Reinforced Brake Shoes

Pattern No. D-67, 2¼ inches to 2½ inches wheel treads; for narrow heads.

Pattern No. D-87, 2¾ inches to 3 inches wheel treads; for wide heads.

And use Solid End Plate Brake heads for Efficiency and Economy.

The American Brake Shoe and Foundry Company
30 Church Street, New York
332 S. Michigan Ave., Chicago Chattanooga, Tenn.



Model 167
Single phase
and Direct Current
Wattmeter

Weston Electrical Indicating Instruments

are unqualifiedly superior in construction, accuracy and service to any other instruments designed for the same purposes.

Weston models include complete Switchboard and Portable groups for service on A.C. or D.C. circuits, and also many instruments designed for special purposes. There is a Weston model for every electrical measurement need.

Write for catalog or bulletin, specifying the field that interests you.

WESTON ELECTRICAL INSTRUMENT CO., 21 Weston Ave., Newark, N.J.

Prevent Blurred Windows with

OPCO Clearshield

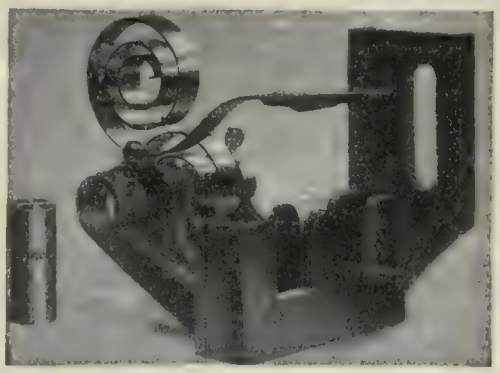
Applied to front windows will positively shed water and prevent condensation.

Opco Clearshield will keep the motorman's window perfectly clear, thereby preventing accidents and eliminating claims for damages caused by motormen not being able to see clearly.

Apply with rag—then polish

For full information, write

Block Automotive Company
Charlotte, N. C.



FLOWER
Railway Brush Holders

SIMPLE—PRACTICAL—EFFICIENT

D. B. FLOWER
1217 SPRING GARDEN STREET
PHILADELPHIA

WHAT AND WHERE TO BUY

Drum & Co., A. L.
Engel & Hevenor
Feustel, Robert M.
Ford, Bacon & Davis
Holst, Englehardt W.
Jacobs & Co., J. L.
Republic Engineers, Inc.
Richey, Albert S.
Robinson & Co., Dwight P.
Sanderson & Porter
Scofield Engineering Co.
Stone & Webster
Wells, Gardner F.
White Engineering Corp., The J.G.

Engines, Gas and Oil
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Engines, Steam
Allis-Chalmers Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Fabricated Steel
Blaw-Knox Co.

Extension Platform Trap Doors
Edwards Co., Inc., The O. M.

Fare Boxes
Brill Co., The J. G.
Cleveland Fare Box Co.
Johnson Fare Box Co.
National Railway Appliance Co.

Fasteners, Belt
Crescent Belt Fastener Co.

Fences, Woven Wire and Fence Posts
American Steel & Wire Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Cleveland Fare Box Co.
Consolidated Car Fender Co.
Electric Service Supplies Co.
Star Brass Works
Western Electric Co.

Fibre and Fibre Tubing
Westinghouse Elec. & Mfg. Co.

Field Coils. (See Coils)

Filters, Water
Scaife & Sons Co., Wm. B.

Fire Extinguishing Apparatus
Castle Inc., James M.

Flashlights
National Carbon Co., Inc.

Floodlights
Electric Service Supplies Co.

Flooring Composition
American Mason Safety Tread Co.
Western Electric Co.

Flooring, Grating
Irving Iron Works

Forgings
Columbia Machine Works & M. I. Co.
Eureka Co.
Standard Steel Works Co.
Williams & Co., J. H.

Frogs, Track. (See Track Work)

Funnel Castings
Wharton, Jr., Inc., & Co., Wm.

Furniture, Metal Office
Edwards Co., Inc., The O. M.

Fuses and Fuse Boxes
Chicago Fuse Mfg. Co.
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Brill Co., The J. G.

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Standard Steel Works Co.

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Electric Service Supplies Co.
Westinghouse Elec. & Mfg. Co.

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Electric Service Supplies Co.
General Electric Co.
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Nuttall Co., R. D.
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Gears, Reduction
Power Engineering & Mach. Co.

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General Electric Co.

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Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

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Massey Graphite Co.

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Green Eng. Co.

Greases. (See Lubricants)

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American Bridge Co.

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Electric Service Supplies Co.
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Anderson Mfg. Co., A. & J. M.
Bayonet Trolley Harp Co.
Electric Service Supplies Co.
More-Jones B. & M. Co.
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Star Brass Works
Western Electric Co.

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General Electric Co.
Ohio Brass Co.
St. Louis Car Co.

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Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
National Ry. Appliance Co.
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Alexander Hamilton Institute

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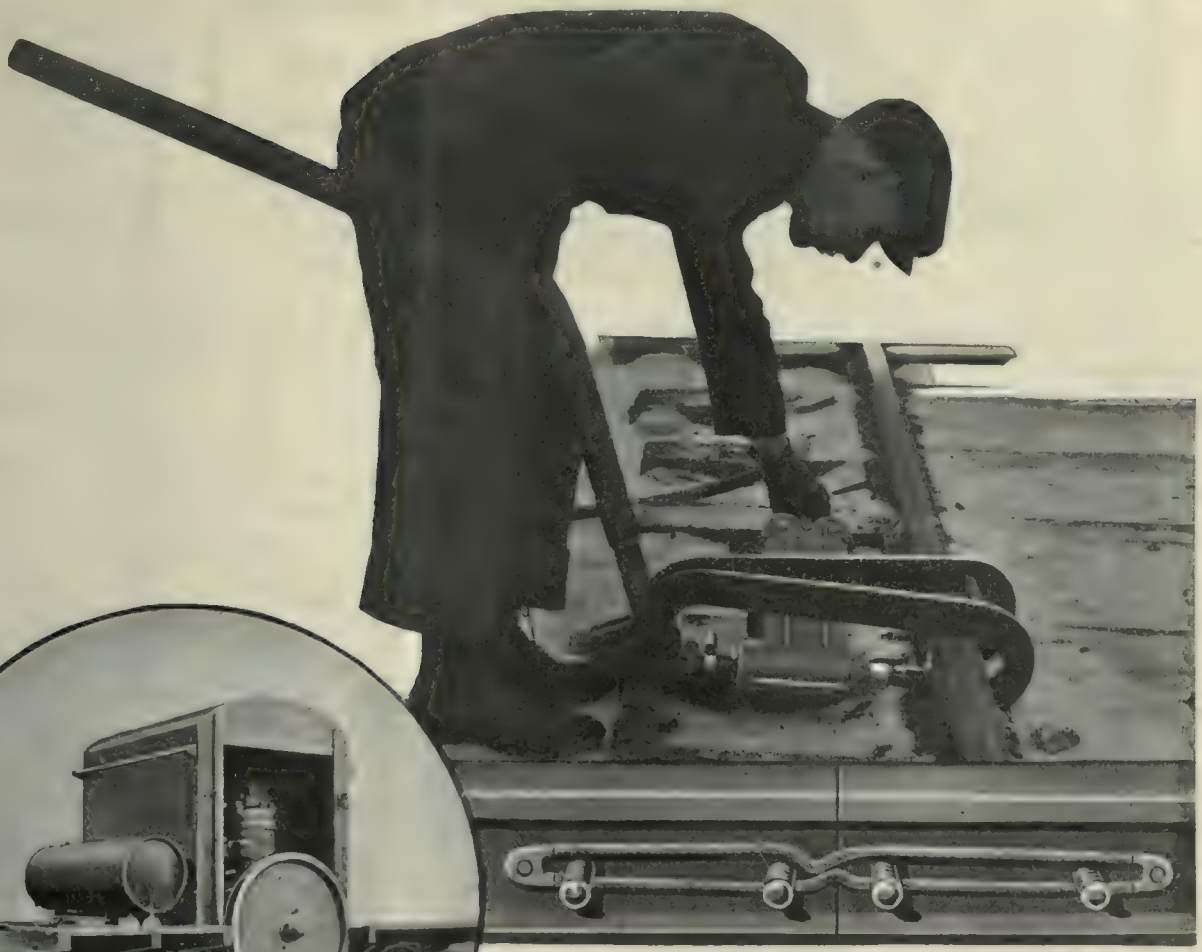
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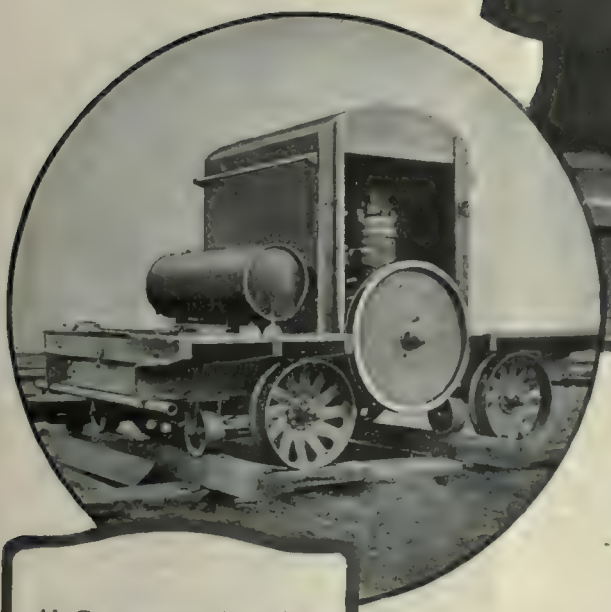
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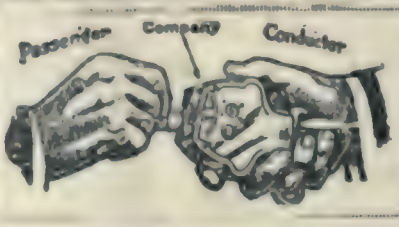
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—the *time* it is idle is wasted when it can render service elsewhere.

—the *space* it occupies costs money and may be needed for other purposes.

—the *labor* of its manufacture is wasted and also the labor of producing a duplicate for the man who *can* use it.

—the *material* it represents would be useful in another form.

Cut out *all* this waste! Don't have material or equipment around that is not needed. Turn it into cash.

There is always a market for either scrap or good used machinery. Conservation of both materials and machinery can be practiced with just as much profit in peace as in war times.

Buyers for surplus material, good used machinery, junk or scrap, can easily be found through the

Searchlight Section

413



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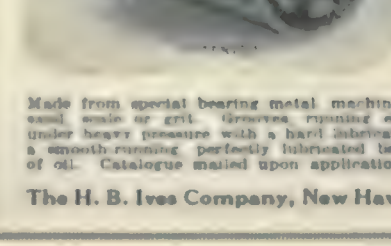
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cars and station steps.

Universal Safety Tread Company

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MASON SAFETY TREAD—Lead or carborundum filled, non-slippery, prevents accidents, cuts out damage suits.
KARBOLITH CAR FLOORING—For steel cars: is sanitary, light weight, fire-proof, non-slippery.
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Trolley Wheel Bushing

Perfect Lubrication

No Oil Required

Made from special bearing metal, machine rifled, eliminating all sand, scale or grit. Grooves running entire length are filled under heavy pressure with a hard lubricating compound, making a smooth-running, perfectly lubricated bearing without the use of oil. Catalogue mailed upon application.

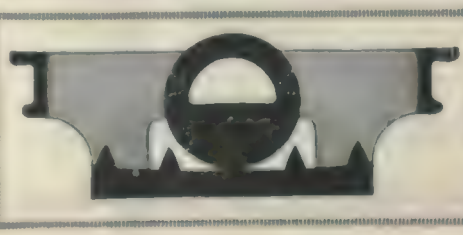
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Bemis Trucks	Manganese Brake Heads
Case Hardened Brake Pins	Manganese Transom Plates
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Bemis Pins are absolutely smooth and true in diameter. We carry 40 different sizes of case hardened pins in stock. Samples furnished. Write for full data.

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The Peter Witt Car:

With its extra-wide entrance and exit door opening and with the conductor located on forward side of the center door, facilitates quick loading and unloading of passengers and with the collection of fares on the "pay-as-you-pass" system eliminates delays during heavy traffic periods, when time means most.

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Philadelphia, Pa.

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Progress

Birney Safety Car Service is an indication of the city's progressiveness, this type of car being the "latest" development in street railway equipment. The character of this service—more frequent, quicker and safer—is the kind that a progressive city demands and is the kind that creates more cordial public relations.

Write for copy of our Publication No. 245, giving complete information on the Birney Safety Car.

BIRNEY TRADE MARK SAFETY CAR



THE J. G. BRILL COMPANY

Philadelphia, Pa.

AMERICAN CAR CO., St. Louis, Mo.
G. C. KUHLMAN CAR CO., Cleveland, Ohio.
WASON MANFG. CO., Springfield, Mass.



General Electric Equipped Safety Cars

The fifty-six safety cars on the lines of the Terre Haute Traction & Light Company are equipped with G-E 258 motors, K control and C-P 25 compressors.

The public has signified its appreciation of the improved service by material increase of patronage on lines where safety cars are run. In addition, a marked reduction in operating costs has been effected through the use of these cars.

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85-50

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Car Advertising Almost Everywhere

Barron G. Collier
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Westinghouse



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have not only proved successful everywhere, but

The Rochester, Syracuse & Eastern Railroad,

which is entirely equipped with HL Control and a large number of Westinghouse No. 306 Motors, is the only interurban road out of Syracuse that was not tied up by snow this winter.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.
Sales Offices in All Large American Cities



Vol. 55, No. 17 New York, April 24, 1920 *Pages 839-880*

Electric Railway Journal

H. W. BLAKE, *Editor*

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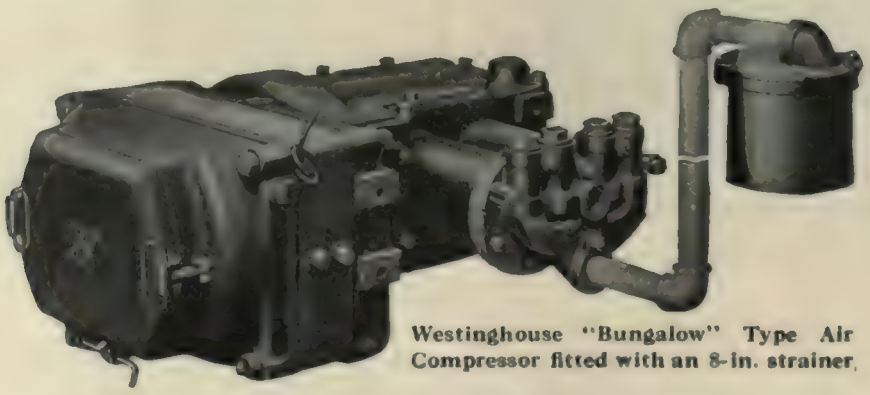
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Advertising Indexes—Alphabetical, 54; Classified, 48, 50, 52; Searchlight Section, 45-47

Efficient maintenance of the Air Compressor is forwarded by providing a good Air Strainer



Westinghouse "Bungalow" Type Air Compressor fitted with an 8-in. strainer

A Good Air Strainer

must be one which, while performing its function of straining the air being drawn into the compressor, will not restrict and reduce the intake of air at the strainer, either by insufficient screen area or by clogging up of the strainer. These two evils, common to air strainers, are avoided in the Westinghouse 8-inch type. Its large screening area permits a gentle flow of air to the compressor, and its practical construction makes easy the process of disassembling to remove collected dirt.

Air Brake Building Our Business For a Lifetime

Westinghouse Traction Brake Company

General Offices and Works: Wilmerding, Pa.

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San Francisco
Seattle, Wash.
St. Louis, Mo.
St. Paul, Minn.
Washington, D.C.



It's a Safety Car in FACT as in NAME According to EL PASO

No matter how good the Safety Car is from the popularity and economy standpoints, it wouldn't be all it should if it did not put Safety *First.*

We couldn't give you much better proof that it does put safety first than to quote the analysis made before the 1919 meeting of the American Electric Railway Claim Agent's Association by Alves Dixon, Claim Agent, El Paso Electric Railway, for an experience covering the operation of about one and one-half million car miles each of safeties and two-man cars:

For every 10,000 *car-miles*

Safeties averaged 3.03 accidents the first year (April 1, 1918—April 1, 1919) compared with 3.95 accidents with the big cars.

Safeties averaged the following 4 months, only 2.95 accidents whereas the bigger cars rose to an average of 5.30 accidents.

And with the Safeties Operating on the More Congested Streets!

There are all kinds of reasons for the superiority of the Safety Car, such as undivided responsibility, front entrance and front exit, greater co-operation from passengers, etc., but the great, big, outstanding reason for its *safety* is the *automatic* interlocking of control, brakes sander, doors and step in a way that makes accidents almost impossible. El Paso's cars are safe cars because they are equipped with the Safety Devices combination of this company, for

It is a Safety Car Only

when equipped with automatic, laborless apparatus, so interlocked that, regardless of the illness or distraction of the operator, the power will be cut off instantaneously, the air brakes and sander apply immediately thereafter and the doors unlatch for safe and easy exit. Furthermore, it is a Safety Car only when the doors must be closed and the step folded before the car can start, and when the airbrake must be applied before the doors are opened and the step lowered in bringing the car to a service stop.

SAFETY CAR DEVICES CO.

Main Office: Boatmen's Bank Bldg., ST. LOUIS, MO.

CHICAGO Railway Exchange Bldg. | WASHINGTON, D. C. Munsey Bldg. | NEW YORK City Investment Bldg. | PITTSBURGH Westinghouse Bldg.

CANADA—Canadian Westinghouse Co., Ltd., Hamilton, Ont.

Phono-Electric

Used on this sharp curve in Glasgow



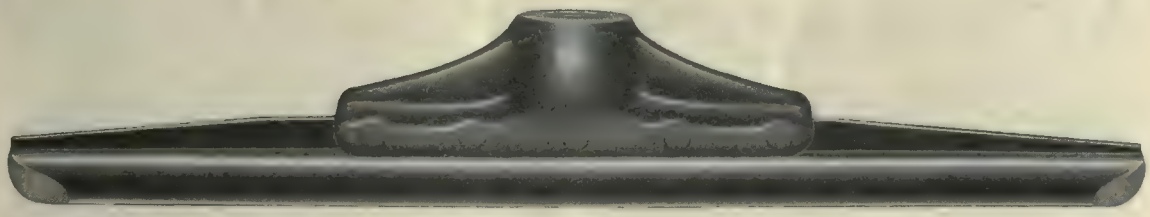
You could hardly ask for a better test installation than this double curve on Ross Street between London and Great Hamilton Streets, Glasgow.

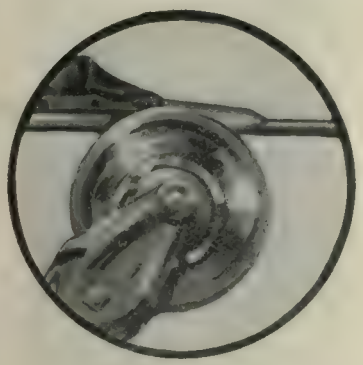
Busy, did you ask?

Why *all* Glasgow lines are busy lines; and it's some compliment to Phono-Electric to try it out in the

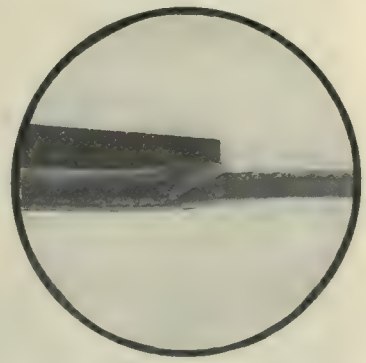
Worst Places First

Bridgeport Brass Company
Bridgeport Connecticut















B

O-B EXTRUDED EARS

For Phenomenal Service

Extruded metal is made by forcing hot (not molten) brass through a die under tremendous pressure. During the unusual manufacturing process it gains many worthwhile characteristics.

Extruded metal is tough and dense—long life—does not curl at ends.

Ductile—folds smoothly in place
Accurate—fits the wire exactly

Rather remarkable records have been made under widely different service conditions. Alternate a few O-B Extruded Ears with your present type and find out how much they will save for you.

The Ohio Brass Company

Mansfield, Ohio

New York Philadelphia Pittsburgh
Chicago Los Angeles San Francisco

Manufactures: Trolley Materials, Car Equipment, Rail Bonds, High Tension Insulators.

"A Penny Saved is a Penny Earned"

Each 100 pennies invested in the New Type Heavy Duty High Speed Indianapolis Portable Patented Electric Welder will pay you 20,000 pennies in return



$600 Complete ready for use

Pay As You Save

Indianapolis "Apex" Welded Joints

are the "fountain of youth" for old tracks and make new tracks better. They increase the electrical efficiency of your whole system.



"APEX" Joint for Guard and Girder Rail

Indianapolis Fluxated Welding Steel

Indianapolis Fluxated Welding Steel makes better welds and increases the life of each and every weld made. Made in enough different grades to meet in the best and most efficient way each and every welding condition.

When welding, protect your operators from the Ultra violet rays with Indianapolis Composite Lenses.

Get our prices on "All-Manganese" Crossings and Tracks

Indianapolis Switch & Frog Co.

Springfield, Ohio



INTERNATIONAL
STEEL CROSSING FOUNDATIONS

take the trouble out of compromise joints near Crossings

THESE specially designed Steel Foundations for troublesome Crossings save maintenance and prolong frog life, but one feature welcomed by many electric railways is the compromise joint step, built into the foundation, which carries the high approach rails of the street track into the arms of the crossing.

The familiar battered low joints at crossing connections may become dangerous if frequent attention is not given to them. They are the cause of much expense.

But on a firm steel bearing cushioned with wood, compromise joints are trouble-proof and safe.

Most of our recent orders are from electric railways who have from four to ten crossing foundations in service.

Let us prepare proposal plans on your Fall renewal.

The International Steel Tie Company

Manufacturers of Steel Twin Ties and Crossing Foundations

General Sales Office and Works: Cleveland, Ohio



Why does pavement last longer when the principle of

Resiliency

is applied to the car tracks?

The Asphalt cushion of the Resilient Railway Tie gives an unvarying deflection to the rail under the weight of the cars. Not too much as in the case of wood ties working in ballast nor too little as in monolithic construction. The joint ties prevent all working at the joints.

These things accomplished by Resilient Ties make toward pavement permanence.

THE DAYTON MECHANICAL TIE CO., 704 COMMERCIAL BLDG., DAYTON, OHIO

PEERLESS PIT JACKS

Absolutely Safe—Fine Adjustment—Two-Speed Operation



Flat top is used for handling heavy gear cases or heavy armature parts.

The new Peerless heavy duty pit jack is designed for work of every character required in the street railway pit. This jack is of the geared wheel and screw type, combining absolute safety with fine adjustment and two-speed operation.

The frame is built up of heavy steel angles thoroughly braced and allows for side adjustment of 10 inches. The top has a minimum height of 3 feet 9 inches and a maximum raise to 6 feet 3 inches, measured from the floor.

The Peerless heavy duty pit jack is operated by a handle and so arranged that two speeds are provided, a low speed ratio for lifting extremely heavy weights and a high speed ratio for lighter work, or for lowering.

This jack is regularly supplied with either cradle top for handling armatures or fitted with a flat top for handling gear cases, motor parts, etc. Tops are interchangeable and are listed saparately so that it is possible to have one jack and two types of tops, changing the latter according to the character of work in hand.

ELECTRIC SERVICE SUPPLIES CO.

Manufacturer of Railway Material and Electrical Supplies

PHILADELPHIA
17th and Cambria Streets

NEW YORK
50 Church St.

CHICAGO
Monadnock Building

Canadian Distributors: Lyman Tube & Supply Co., Ltd., Montreal, Toronto



One of many Thermit-Welded frogs installed in Youngstown, Ohio., still in fine condition after several years' service.

THERMIT-WELDED Special Work Means Standard Rails Plus a Few Hundred Dollars

The cost of Thermit-Welded special work is so low that you would naturally suppose that it could not be of *permanent* character.

But this is not the fact at all as has been demonstrated *by five years of careful trial and observation.*

Special work has been made up of ordinary rails before, but it has lacked permanence because it was bolted multi-part work that could not stand up for any length of time.

The application of Thermit Welding to ordinary rails is entirely different, because, by obliterating so many joints that are just that many points of shock, it avoids the racking and loosening that are inevitable with any type of mechanical fastening.

It's the Elimination of Joints That Assures Long Life to Thermit-Welded Work

Because the entire layout is made as shockless as a piece of special work ever can be. Having been started right, a layout that is Thermit-Welded will stay right at a total overall cost that is far below what you could secure in any other way.

Just advise us what rail sections you use and how many crossings of each you wish to make, and we will quote you prices at once. The permanent Thermit equipment can also be used for welding compromise joints, broken motor cases, truck frames, armature shafts and many other heavy steel sections.



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Chicago

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San Francisco
Toronto





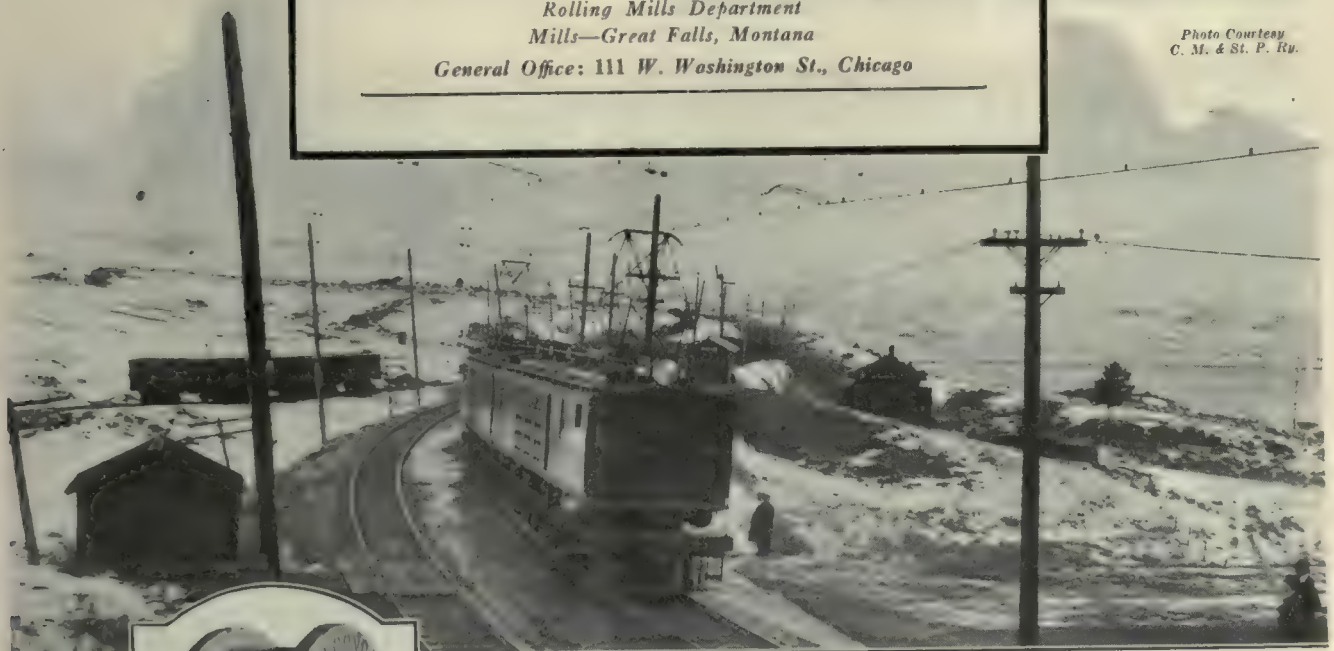
Anaconda Copper Wire is made from the famous B & M Brand Electrolytic Copper Bars. These bars possess high electrical conductivity and physical soundness. They contain less than 1/100 of 1% metallic impurities.

This accounts for the remarkable strength and purity of Anaconda Copper Wire and explains why it fully satisfies the requirements of those who use it.

When new construction or additions to existing lines are contemplated, it will pay you to allow our engineers to figure on your needs.

ANACONDA COPPER MINING COMPANY
Rolling Mills Department
Mills—Great Falls, Montana
General Office: 111 W. Washington St., Chicago

Photo Courtesy C. M. & St. P. Ry.





ANACONDA Copper Wire
"From Mine to Finished Product"

Here's good evidence of benefits from Abbott Rail-Joint Plates



THE ABBOTT RAIL JOINT PLATE
"BUILT LIKE A BRIDGE"

The Abbott Plates shown here were installed in 1910 on west bound main line track of a prominent road. To date no extensive track repairs have been required nor will there be for a long time to come. The east bound track at the same location is *not* equipped with Abbott Plates and has every appearance of needing extensive repairs. The rail ends on this latter track are battered to a noticeable extent, although those on the west bound Abbott-Plate-equipped track are in excellent condition.

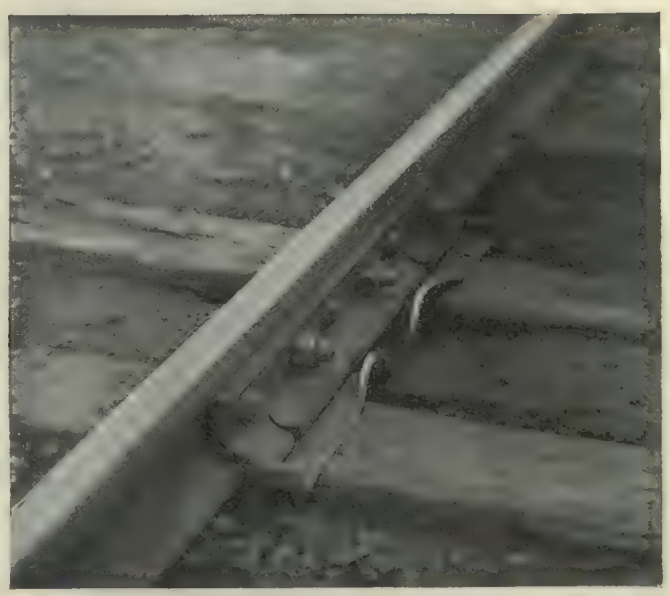


The track supervisor stated that the Abbott Plates gave a noticeably smoother running track and were themselves in as good condition as when installed ten years ago. The nuts and bolts stayed tight longer than on track where no Abbott Plates were used, and the tendency of the rails to creep had been controlled by the anti-creeping features of the Abbott Plates.

Abbott Plates put in at the time the track is first laid is of course the more logical procedure, but for preserving old track, bringing and keeping it up to line, making the old ties last longer and reducing future maintenance expense, these plates are the best investment that can be made for track economy.

They can be installed without expensive disturbance to the existing track, angle bars and ties, and will effect even greater economies on old than on new track and will effect a notable improvement in smoothness of running.

By using the full complement of track and plate holding spikes (which are independent of each other) the track is held much

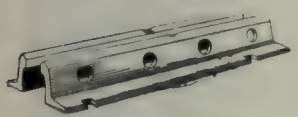


firmer than with the fewer spikes ordinarily used, and as the spikes stay tight much longer, "spike killing" of the ties is avoided, with a decided saving in expense for new ties and their installation.

The economies and service improvements effected by Abbott Plates can be quite accurately estimated in advance, and if you will tell us your conditions, our engineers will submit interesting data.

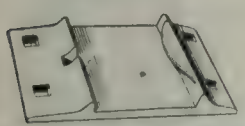
Other Lackawanna Aids to Better Track

The Lackawanna Safety-Head Angle Bar



overcomes liability to wear and fracture by preventing cutting of the bar at the top from back action or upward thrust of the rail ends. This is accomplished by a slight depression in the head of the angle bar for a short space at the center where the rail ends meet.

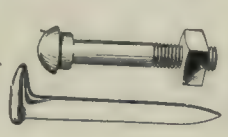
The Lackawanna Hook-Shoulder Tie Plate



is simple, strong, durable, convenient for installation, and by holding the rail with great security prevents undue wear and destruction of material; saves repair costs and reduces maintenance labor.
Two ribs on top form a channel in which the rail base rests. One of the ribs is plain and the other hooked to make a holder. One or two plain spikes on the plain rib complete the bond between plate and both rail flanges. The plate is fastened to the tie by independent plain or screw spikes. The rail may be removed without disturbing the plate.

The Lackawanna Deseaming Process

to which all our rails are subjected, leaves the rail head and base free from the cracks and weak, streaky, laminated, partially decarburized metal that under ordinary manufacturing processes is an inherent cause of undue surface wear and rail fracture.



Lackawanna Track Bolts and Spikes

Our track bolts and spikes of all standard sizes for light or heavy rails, enjoy an enviable reputation for careful, accurate workmanship and finish.

Write for our booklets, "Lackawanna Deseamed Rails," "Lackawanna Improved Track Appliances," and "Lackawanna Track Bolts and Spikes."

Lackawanna Steel Company

General Sales Office and Works: Lackawanna, N. Y.

Atlanta Boston Buffalo Chicago Cincinnati Cleveland Detroit New York Philadelphia St. Louis San Francisco

Sole Exporter of Our Commercial Products: Consolidated Steel Corporation, 165 Broadway, New York.

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ARMCO

AMERICAN INGOT IRON

An Old Installation

A recent inspection of this 50-foot Armco Culvert revealed not the slightest sign of deterioration, although it was placed under the roadway thirteen years ago.

The enduring qualities of rust-resisting Armco Culverts made of American Ingot Iron account for their increasing use by experienced engineers and highway commissioners.

There is a manufacturer in nearly every state, and in Canada, making genuine rust resisting ARMCO CULVERTS and other products of American Ingot Iron such as flumes, siphons, tanks, road signs, roofing, etc. Write for full information and nearest shipping point on products in which you are interested.

ARMCO IRON CULVERT & FLUME MFRS. ASSN.
TRANSPORTATION BLDG. CHICAGO



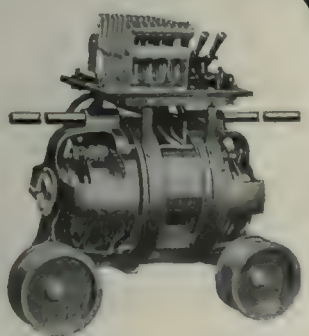
INTRODUCTION

Electric railroading, strange as it may seem, in the expanse of a quarter century has not yet achieved the *All-but Perfect State*—that state into which it must be received in its entirety before, road by road, it is ushered in to the *Perfect State*.

The railroad man being aggressive is anxious to achieve that state—but there are many factors that militate against speed in the achievement of ideals. Public Service commissions and engineering omissions have created a need for an authoritative work as a trail blazer—or shall we say mental preparer—for the *All-but Perfect State*.

This work—chapter by chapter—with the product illustrated below is devoted to such constructive work as preparation for the *All-but Perfect State* in the irreducible minimum of time consistent with the requirements of the *All-but Perfect State*.

Next week on this page this ultra-educational series begins under the well chosen title of Chapter One. Don't miss a single installment, as that may cause a weak link in the chain of thought necessary in preparing for the *All-but Perfect State*.



READING NO. ONE

What Is the Dynamotor Anyway?

It is a piece of equipment to save money for roads *in large installments*.

By a little planning a Dynamotor equipment can be made to save money day in and day out.

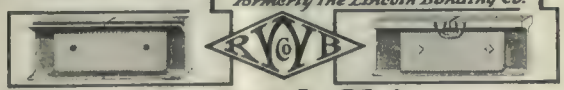
But it does more than save money.

—as a bonder and welder for rails it gives you the one practical scientific method.

—as a shop welder it saves the delays and costs of getting new parts.

The Rail Welding and Bonding Company

formerly The Lincoln Bonding Co.



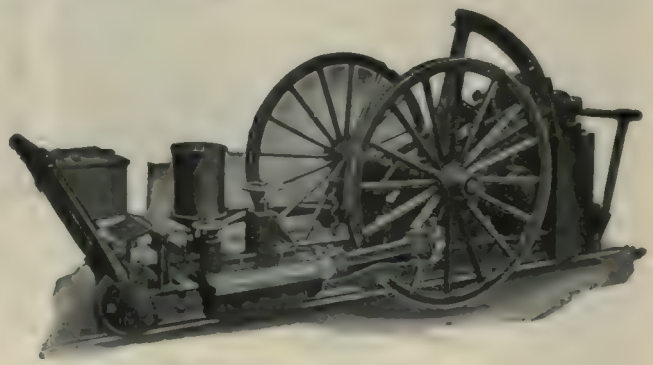
Cleveland, Ohio.

THE SOLUTION OF YOUR TRACK GRINDING PROBLEMS

Can be found in the products of the Railway Track-work Company

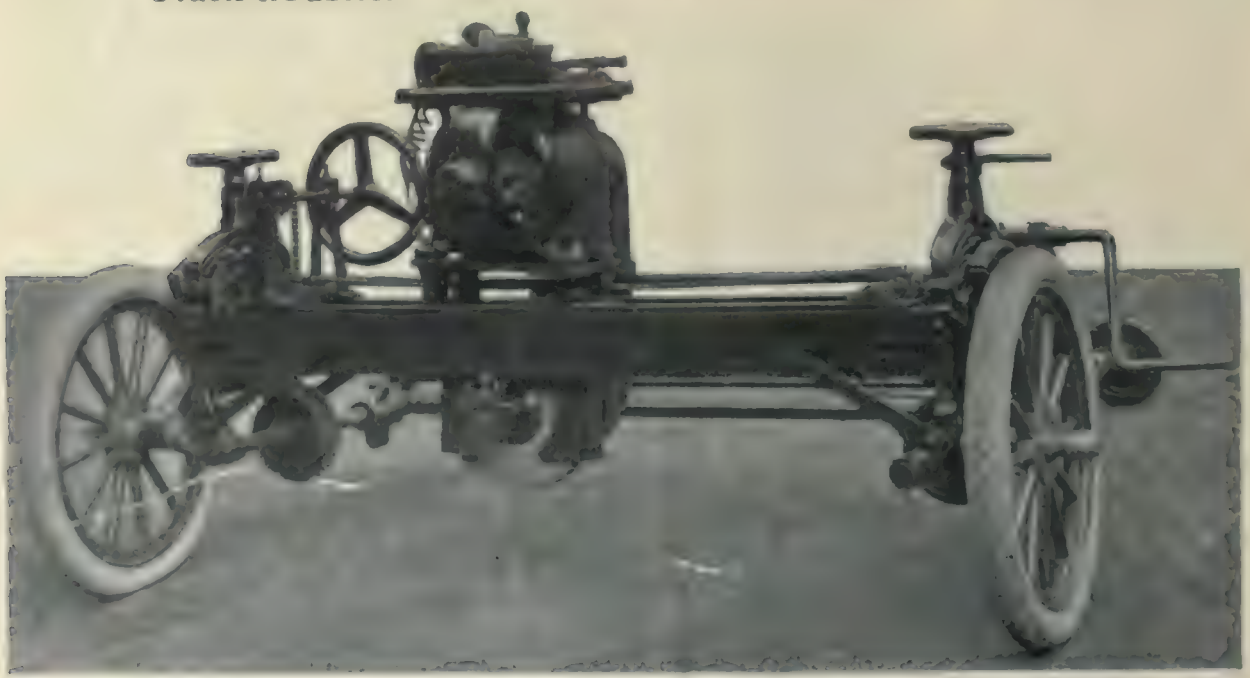


Atlas Rail Grinder



Reciprocating Track Grinder

The Universal Rotary and Atlas Rotary as well as the Reciprocating Track Grinders, suffice for all Track Grinding needs. Let us suggest the remedy for your Track troubles.



Universal Rotary Track Grinder

RAILWAY TRACK-WORK COMPANY

3132-48 East Thompson St., Philadelphia

Exclusive Agents

ATLAS RAILWAY SUPPLY CO.
Chicago Ill

ELECTRICAL ENGINEERING & MANUFACTURING CO.
Pittsburgh Pa

Exclusive Agents

CHAS. N. WOOD CO.,
Boston Mass

HITCHCOCK, LLOYD & CO., Inc.,
77A Queen Victoria St., E. C.
London England



Ten times faster—90% cheaper

LITTLE GIANT Electric Track Drills soon save their cost. They are now standard equipment on hundreds of leading properties throughout the world. Track gangs equipped with "Little Giants" commonly perform track drilling operations at speeds *ten to twelve times faster* than old-time hand methods and at a saving of 85 to 90% in cost. One company reports that one Little Giant Track Drill released 15 men and 5 drills—and does more work at that! Your track repair and construction equipment is incomplete without this and other Little Giant Portable Electric Tools, such as screw spike drivers, portable drills and grinders, etc. Write for bulletins.

Illustration shows one of several Little Giant Track Drills in use by the Pittsburgh Railways Company, Pittsburgh, Pa.

Chicago Pneumatic Tool Company

Chicago Pneumatic Building . 6 East 44th Street . New York

*Sales and *Service Branches all over the World*

*Birmingham *Boston *Buffalo *Chicago *Cincinnati *Cleveland *Detroit Eldorado El Paso Erie Franklin Houston Joplin *Los Angeles Milwaukee *Minneapolis *New Orleans *New York *Philadelphia *Pittsburgh *Portland Richmond Salt Lake City *San Francisco *Seattle *St. Louis Tucson Barcelona *Berlin Bombay Brussels Buenos Aires Cadiz Christiania *Fraserburgh Havana Honolulu Johannesburg Lisbon *London Madrid Milan *Montreal Osaka *Paris Seoul Tokyo Toronto Vancouver Winnipeg

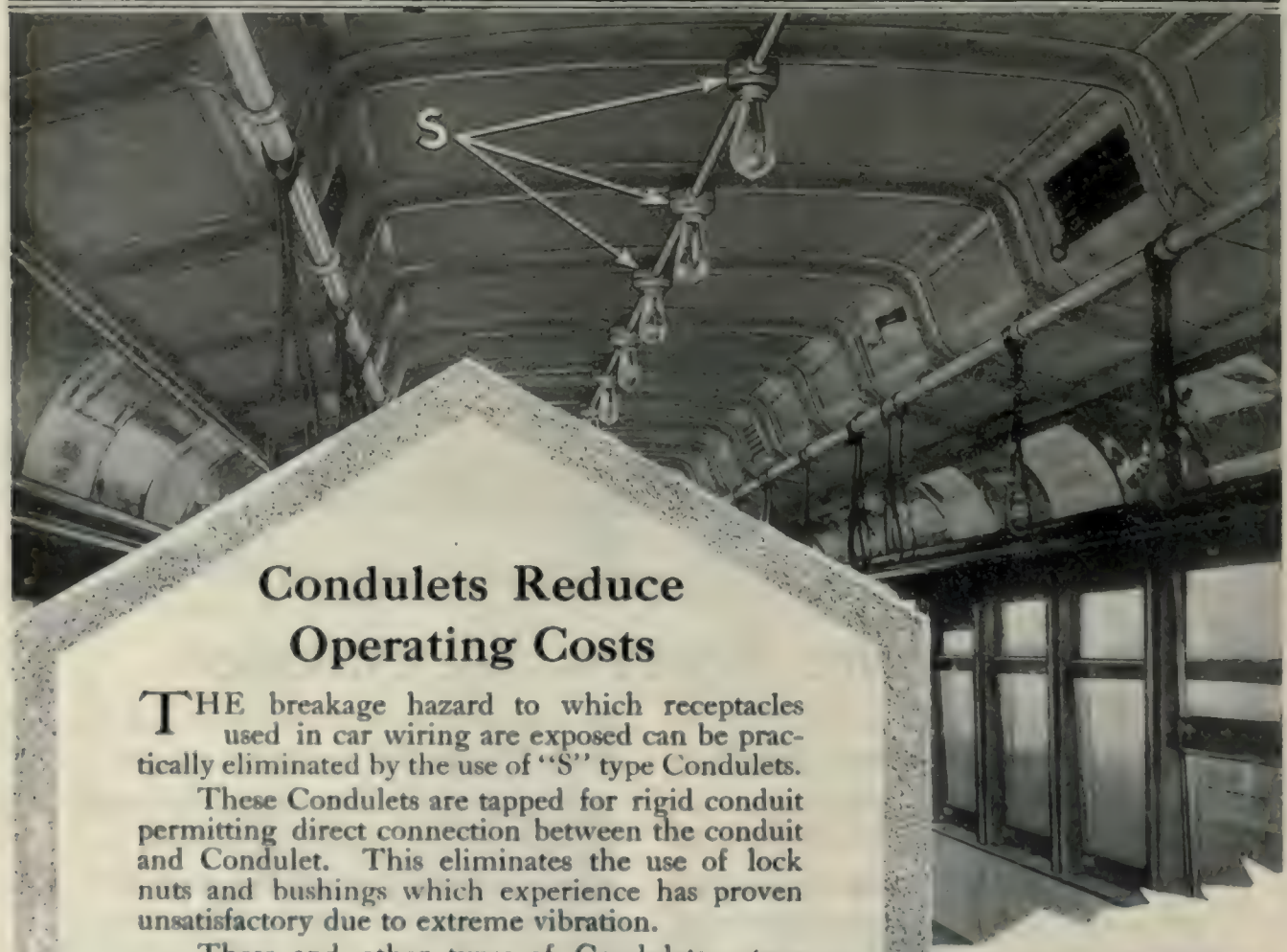
EL-31

BOYER PNEUMATIC HAMMERS · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · VACUUM PUMPS · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES · ROCK DRILLS · COAL DRILLS

CHICAGO PNEUMATIC

LITTLE *Electric* **GIANT** *Tools*

CONDULETS



Condulets Reduce Operating Costs

THE breakage hazard to which receptacles used in car wiring are exposed can be practically eliminated by the use of "S" type Condulets.

These Condulets are tapped for rigid conduit permitting direct connection between the conduit and Condulet. This eliminates the use of lock nuts and bushings which experience has proven unsatisfactory due to extreme vibration.

These and other types of Condulets extensively used in car wiring are described in the Crouse-Hinds Catalog.

Send for a copy.

CROUSE-HINDS COMPANY

SYRACUSE, N. Y.

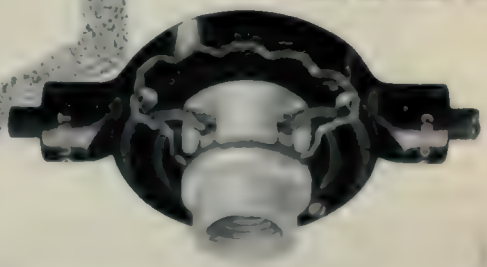
BOSTON NEW YORK CHICAGO

Condulets Panelboards
Knife Switches Floodlights
Guy Anchors

1554

S CONDULETS

Ease of installation, strength and appearance characterize these condulets which are considered an essential part of every good car wiring job.



Condulet the Job

CROUSE-HINDS

Meet the Public Demands



Increase Your Service without Increasing Your Rolling Stock

by Equipping Your Cars with

National Pneumatic Door and Step Control

The Public demands quicker service especially during rush hours. It probably has been impossible for you to speed up your service because your car stops have been too long. Your conductor has had his hands full collecting the fares and could not shut the door without losing lots of time.

By equipping your cars with National Pneumatic Door and Step Control you not only save the conductor's time but speed up each car. The stops get shorter. The running time is decreased which enables you to get more trips out of the same number of cars, thereby making the service frequent.

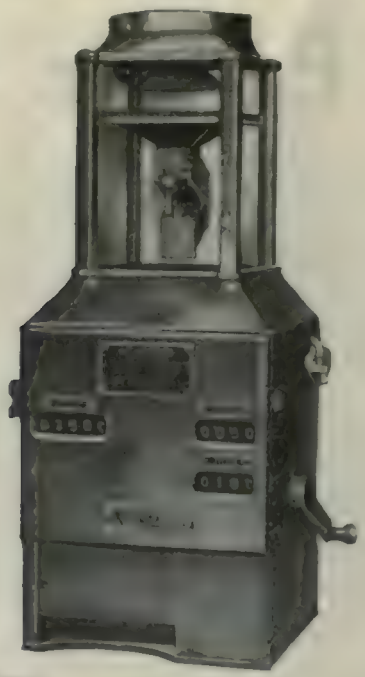
This makes a better satisfied public and increases your revenue.

National Pneumatic equipment pays for itself in a very short time out of the saving effected.

NATIONAL PNEUMATIC COMPANY INC.

50 Church St., New York **Edison Bldg., Chicago**

Works: Rahway, N. J.



Selling Transportation

THE ambition of every railway management is to "popularize" transportation and to come as near as possible to furnishing service at cost, including a reasonable return on a fair investment. Railway operators would rather hold the rate of fare at a low level and thus encourage growing patronage.

The use of **metal tickets** with registering fare boxes is becoming recognized generally as the best method of securing additional business where rates have been raised above the old 5-cent standard. The reason is that experience has shown that the **ideal fare-collection system is based on a unit fare,** whether this be a single coin or a metal ticket. Those who are responsible for keeping down the number of car hours will appreciate why this is true.

From our study of the subject in numerous cities, we are convinced that the best returns in the way of increased revenue and fast schedules are shown on properties where the use of metal tickets has reached a high percentage.

THIS SUBJECT *should interest all railway men. We can mention specific cases where beneficial results are now being shown. We will be glad to make a study of your particular situation and point out a remedy.*

Johnson Fare Box Company

Jackson Blvd. & Robey St., Chicago
50 E. 42nd St., New York



The Essence of Galena Service

EDUCATION in the use of "the right oil in the right place" is good in itself, but the value of the lesson is lost unless the *right oil is used*.

Galena Service represents the most complete and efficient organization of its kind in the business world —the personal services and co-operation of lubricating specialists who not only *know how*, but can *show how*.

GALENA QUALITY

But even the supervision of these experts could not produce the remarkable operating results that Galena Service attains were it not for "Galena Quality," the feature that makes Galena products the standard railway lubricants of the world. It is the necessary and indispensable element that makes Galena Service successful in its educational work of improving operation through scientific lubrication methods.

Galena Quality is Our Bond and Your Security!

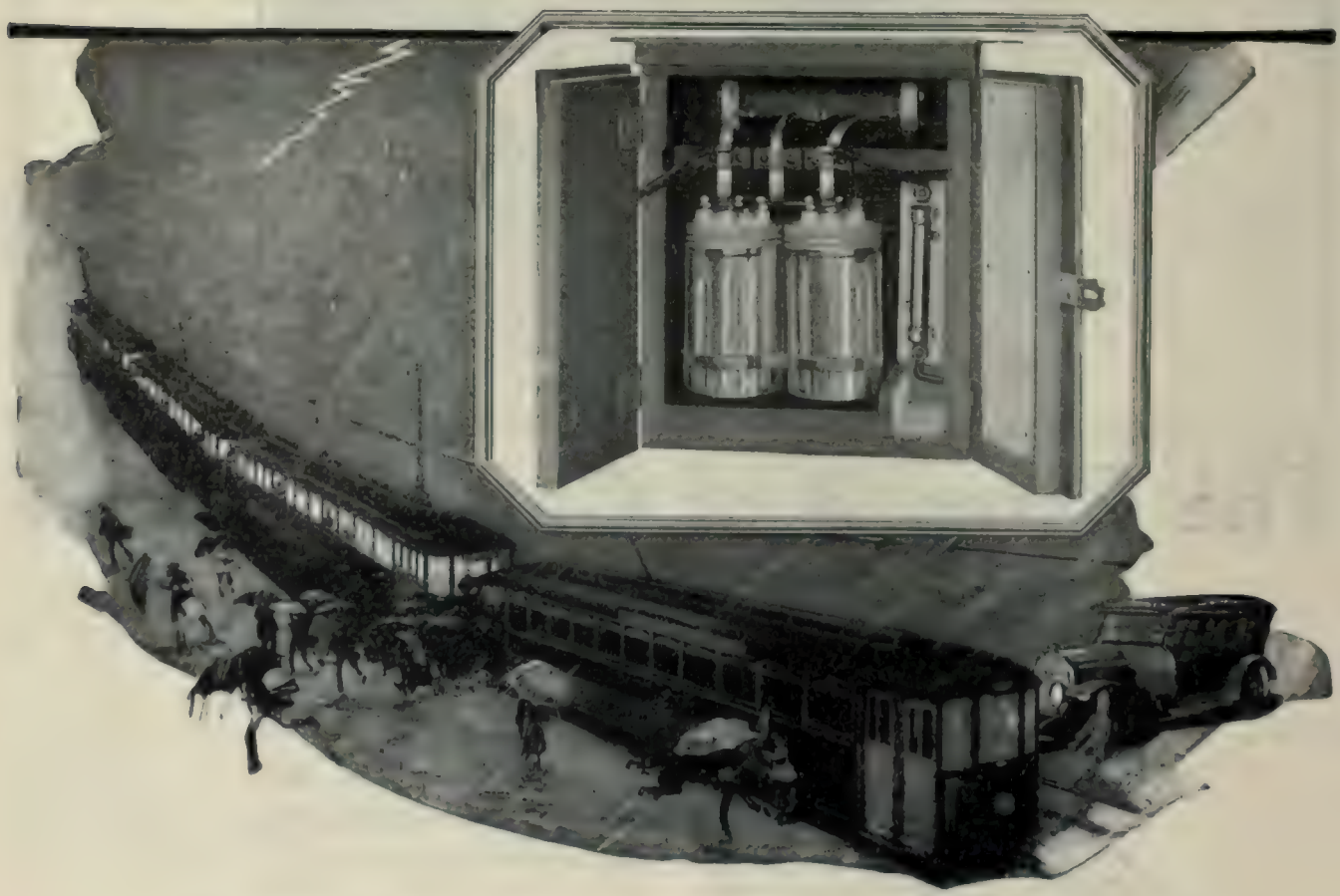
Galena-Signal Oil Company

New York *Franklin, Pa.* *Chicago*

and all principal American cities

LONDON TORONTO BUENOS AIRES MONTREAL PARIS

Why risk a loss when such a simple, economical and efficient protective device is available?



Protect Your Service

How often it happens that the most severe electrical storms break just at the heavy traffic hour.

One car put out of commission then causes congestion—delay—loss of fares—irritated patrons.

You surely cannot afford to lose any of the public's good will, or any of its patronage.

G-E Aluminum Arresters

installed on your cars will make it possible for you to continue operation throughout the heaviest lightning storms, in safety. Do you realize how soon the lightning storms will come?

33B-44

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

Electric Railway Journal

Consolidation of STREET RAILWAY JOURNAL and ELECTRIC RAILWAY REVIEW

Volume 55 — New York, Saturday, April 24, 1920 — *Number* 17

The Next Convention of the American Electric Railway Association will be held at Atlantic City, N.J., on Oct. 11-15, 1920.

The American Electric Railway Association announced this week the time and place of its next convention, as given above. Atlantic City has become the logical place for national conventions, especially for those with exhibits, and the selection will give general satisfaction.

Edward Hungerford Will Talk About Electric Railways in This Paper

WE COMMENCE this week the publication of a series of articles by Edward Hungerford on the electric railway situation of today in several cities. This paper has had in the past many accounts on the properties in these cities and on the industry in general from what might be called the "electric railway side." We have thought that it would be interesting, therefore, to our readers for us to publish the viewpoint of some one not closely allied with the industry, and we have selected a well-known magazine writer, who, not being so near to the problem, could see it in a perspective not possible to one daily engaged in electric railway work.

Our understanding with Mr. Hungerford was that in these articles he would have entire freedom to express his opinions on conditions as he saw them. With this understanding he was glad to accept the commission. Obviously, for the reason just given, Mr. Hungerford is responsible for the opinions expressed in the articles and not the editors.

In conclusion, we need only add that each article is based on a special visit and personal study of the transportation system in question by Mr. Hungerford. These visits were made during the past three months for the purpose of collecting material for this series of articles.

Fareless Passengers vs. Wageless Trainmen

ACCORDING to the latest news from Soviet Russia 'most everybody is an employee of the government, and as government employees don't have to pay fare the operation of the street railways has been reduced to the simplest terms. Life for the conductor is now one round of joy, for while his work has been reduced enormously his nominal wages at least have also been increased enormously.

How different is this picture from that presented to us by conditions on the Norton & Taunton Street Railway Company, which, in spite of its name, is now jointly owned by the cities of Taunton, Attleboro, Mansfield and Norton. On this line the proletariat, the salariat and the bourgeoisie must pay fare as of yore. But what about the trainmen? They, poor fellows, are reported in an April 5 despatch to the Boston *Herald* as being prepared to quit after failing to see the payday ghost walk in three successive weeks. It is true that one conductor is said to have organized a little Soviet of his own by borrowing $10 from his traffic receipts as a draft on his pay, but most of the men have advised the management that they can't extend credit much longer; that while they are in a most entertaining kind of social welfare work, which brings them into contact with all sorts of the best people, they are not immune to the demands of Nature.

It looks to us as if the Russian comrades have a more desirable form of government ownership than their American brethren. No fare collection and more pay certainly sounds better than more fare collection and no pay.

How to Write an Ad for Platform Men

AN ADVERTISEMENT, like a word, often conveys to the reader a meaning or an impression very different from what the writer intended. This thought was thrust upon us as we read a recent car poster which asks that men whose "records can stand investigation" apply for platform jobs. Probably the writer of this card did not intend to hurt any one's feelings, but isn't it rather tactless to assume gratuitously that some of the men who might apply would have records that will not bear investigation? Why bring up this aspect at all, inasmuch as the very first thing an applicant is asked to do is to furnish satisfactory references? Every job seeker knows that. Now, how much better it would be if the writer of this advertisement had seized upon the man shortage of his company as a means of bettering relations with riders and employees. Assume that the wording was something like this:

"We have the cars but not enough men to give you the service to which you are entitled. If you know any high-grade men to whom platform work might appeal, or if you are desirous of entering such service yourself, please get into touch with us."

The foregoing need not be the exact words, but it is believed that they would have the twofold effect of making the public more patient with shortcomings and of making the present employees have a higher respect for their calling. Splendid examples of "help wanted" advertisements that do have such influence are offered by those of the Bell telephone companies. Also, in the very same town where our railway is located is a laundry which carries right on the wagons a statement of its exceptionally attractive labor conditions: "Girls, why not work under the pleasant conditions of the ——— Laundry? The hours are so and so, minimum wage so and so, etc." If this does not get ideal help, it surely does accomplish something toward mollifying

the bachelor who finds that he is expected to wear a brassiere instead of a boiled shirt for that dinner of the Grape Juice Improvement Association. Verily, there are indirect as well as direct ways of selling through creating a better atmosphere for the product.

What Is a Safe Light Rail for Safety Cars?

THE increasing use of the safety car continually calls attention to the question of rails of lesser weight which may possibly be used under such cars. There is considerable talk, but little data, to the effect that lightweight safety cars cause less rail wear and lessen track maintenance costs. Logically these desirable features may be present where these cars are in use but the cars have not been in service long enough to warrant any assumption as to what the savings may amount to. Furthermore, the cars are usually sandwiched in between heavier cars on most systems which have adopted them and the lessening in track wear is difficult to determine. It is also a well-known fact that our accounting methods seldom have permitted us to determine with any reasonable degree of accuracy what track maintenance costs are upon particular lines or sections thereof. Until some road has operated a line solely with these cars for a period of several years and has kept some comparative track maintenance data covering the "before and after using," as the patent medicine "ads" have it, we are unlikely to know much about the maintenance cost and wear-and-tear phase.

Meanwhile it is reasonable to assume that some tracks may need rebuilding soon where safety cars are operated. The selection of the new rails for the tracks then becomes a problem worth consideration. Some calculations show that an 8.5-ton safety car with a 60-passenger load would have a static wheel load of 6,500 lb. and a dynamic augment (addition of 0.70 of the static load) of 4,500 lb., giving a total dynamic wheel load of 11,050 lb., and that it would require a rail weighing about 50 lb. per yd. under the Baldwin Locomotive Works rule for safe weights of rails. But a 50-lb. rail is altogether too small for use in pavements and would be out of the question for use under almost any other cars which are still in service. The matters of adaptability of the rail to varying pavement conditions, adequacy of rail joints and need for allowance against corrosion with provision for reasonable wear before renewal also enter into the conditions to be met in the rail selection.

These items all tend toward the selection of a rail weighing not less than 70 lb. per yd. with a height of not less than 6 in. We have the 6-in. 72-lb., the 7-in. 70-lb. and the 7-in. 80-lb. rails in the plain girders from which to make a choice. The 5-in. 80-lb. A. S. C. E. rail is probably the lightest weight and least depth of rail which should be used with the few modern pavements which can be adapted to it. Our choice then would range, as determined by paving conditions, other car traffic and ordinances, between rails weighing from 72 to 80 lb. per yard. In view of the good service which ancient 7-in. 70- and 80-lb. rails have given in the past, it appears that we shall hardly need to go above 80 lb., but with an increase in safety cars to practical exclusion of other and heavier types we might safely go to the lower limit of about 70 lb.

The available groove girder rails do not offer such advantages in rails of appropriate weight. The groove necessarily adds weight in any case. While there are four groove girders weighing from 90 to 100 lb. and five weighing 103 to 105 lb., most of them have certain poor features of design. Those under 100 lb. all seem to have the gage line too close to the center line of the web. If the selection of these rails for safety car tracks becomes insistent, some attention should be given toward a betterment and standardization of design. Past experience cautions against the use of rails of too light a weight and it must not be forgotten that weight adds salvage value at the end of service life. A reasonably high weight over bare necessity is always a form of insurance against the future.

Another feature of the track construction with reference to suitability for safety cars is that of ballast. We believe that most track engineers are agreed that a ballasted track construction is the best for average soil conditions prevailing over the country. The lessening of car weight should not be used as an argument in favor of lessening the depth of ballast to be used under a safety-car track. The depth under the ties should certainly not be decreased below the quite generally used 6 in., because this is 25 per cent less than the 8-in. depth recommended by the committee on way matters in its report on ballast.

British Experience Shows More Riding Follows More Leisure

A BRITISH electric railway manager who is still among the select few operating on pre-war rates of fare calls attention to one of the interesting reasons for this happy condition, namely, the radical shortening of the workday in his country. Before the effort to "make Britain fit for heroes to live in" the manual worker had to be on the job at 6 a.m. or earlier, leaving a hiatus of one hour or more between the manual and clerical loads. There was a certain amount of "breakfast riding" in some cities, but generally speaking the morning peaks came at two widely separated periods. With the arrival of the eight or nine-hour day many British managers feared that their peaks would assume the highly concentrated form characteristic of America, inasmuch as all classes of workers would be going and returning within the same hours. It may well be that such will prove the case in some cities. In others, however, this undesirable shift has not occurred for two reasons at least.

In the first place, the introduction of the eight-hour day in shipbuilding and other mechanic arts has led to the two-platoon and three-platoon system, especially because of the great need for technical equipment. This change naturally has improved the load factor by giving quite as good rush-hour traffic in one direction as in the other. In the second place, the shortening of the workday has given the laborer an opportunity for leisure, whereas a twelve-hour day left him too fagged out for anything but to eat and sleep. As the result of this leisure, he and his family go a-visiting or to amusement resorts on a much more liberal scale than before. One point which our British friend did not mention, because it is doubtless so matter of course with him, is that this leisure riding is really neighborhood riding, and that this neighborhood riding is the logical result of years of development of the principle of a short ride for a short fare. The fact that nearly all of this extra riding is within an average of less than 1 mile per passenger shows how the flexibility of a zone fare aids in taking advantage of conditions that would mean little or no change on a flat-fare system.

"Here a Little, There a Little" in Steam Road Electrification

THERE will be no avalanche of steam railroad electrification until finances become stabilized and credit is restored. But the process will go on gradually with increasing satisfaction to all concerned. Every few days there is an announcement of some new order or project, such as that regarding the Paulista Railway in this issue of the JOURNAL, another regarding the Hershey Cuban Railway two weeks ago, etc. Such straws as these show the direction of the wind. At the coming Pasadena meeting of the National Electric Light Association there will be a special symposium on railway electrification, indicating that electric power producers sense the importance of this coming field for their output. Herbert Hoover, president of the American Institute of Mining and Metallurgical Engineers, this week gave out a report, made after a conference with representatives of the American Railroad Association, in which electrification of railroads is urged and the "super-power" plan of power generation and distribution is indorsed.

The proponents of conservation and transportation improvement by electrification have every reason to be encouraged by the present prospects. The change to electric motive power is bound to come in a substantial part of the heavy traction field. In the programs for needed rehabilitation to be carried out during the next few years it must have a conspicuous place.

The Wonders of Modern Urban Transportation

THE rapid transit trains of the Interborough Rapid Transit Company of New York City recently carried a very effective issue of the *Elevated Express* and *Subway Sun* showing graphically the distances to which New Yorkers can be carried on the subway lines for a nickel and also the comparative fares for steam railroad suburban service in the same territory. The *Express* and *Sun* are familiar to the readers of this paper through the copies which have been reproduced in its columns from time to time. One of the particular issues referred to was reproduced in the April 3 ELECTRIC RAILWAY JOURNAL, page 694.

If the impression made by this poster upon other patrons of the "L" and subway lines was as vivid as it was in the case of the writer, the general sense of appreciation of the quantity of service which one gets in New York for a nickel was considerably intensified. The one-way fare per mile on the steam roads was shown to be from ten to thirteen times that on the subway lines. In justice to the steam roads it must be allowed that they do much better for regular commuters, who pay from a fourth to a third of the single-fare rates if they utilize their privileges fully. It is the regular rider on the subway, also, who utilizes most fully his long-distance-travel privilege. But even with this allowance there is still a marvelous difference between the fares in the two cases, a difference which is much larger than that in the investment necessary to permit the service to be given.

The discrepancy between these two classes of fare is due to a number of factors. Of course, to begin with, the nickel is too low a fare for even the average ride in the subway, to say nothing of the maximum ride. But even if a reasonable fare were permitted to be charged, it would be low compared with the steam road fares, because a well-operated electric road can furnish transportation more efficiently than the steam road, at least under conditions such as obtain in New York. And the occasional rider is especially well treated by the electric road. He gets the same rate as the regular patron, whereas he is heavily penalized by the steam road. But whatever the causes which enable the Interborough to give the service it does at the fare it charges, a comparison with steam road suburban service and charges ought to be fruitful in fostering a reasonable attitude on the part of the public toward the need of the utility for a reasonable fare.

Detroit Embarks on Tempestuous Seas

THE political tumult and shouting have died in Detroit. The city now faces the stern realities of what it means to enter upon the program for municipal ownership approved at the recent election. An initial fund of $100,000 out of the total authorization of $15,000,000 was quickly made available with which to begin work on the municipal railway. The first move was the "starting" of construction on April 6, when the Mayor, spade in hand, began digging at Connors Road and Charlevoix Street. The election was held on April 5. This was quick work and good politics. That one spade of earth, however, appears to have uncovered a lot of trouble for the city.

With the abstract question of municipal ownership and operation we are not here concerned. The fact is that Detroit has decided upon the piecemeal construction policy, with an implied if not actual threat to order the Detroit United Railway off certain streets upon which it is now operating under its expired franchise rights.

Detroit must first prepare for the actual construction of its new lines. Then it must build the lines, and finally set up the machinery for their operation. The program which has been laid down is fairly comprehensive. It remains to be seen how far the $15,000,000 approved at the election will carry the city toward the consummation of that program. But before the city even starts on its program it is faced with very grave difficulties. The Detroit United Railway appears to have a strong case in its favor against some of the proposals of the city. In addition to this, the east side of the city is organizing against the plan of the Mayor because it feels it has been left out in the cold. Detroit's troubles, great as they may have seemed to some in the past, really are only starting if the city sticks to its program, announced or implied, and the company seeks redress from imposition in the courts.

At the election a year ago the city rejected the purchase of the local lines. More recently the city decided against the service-at-cost proposal. During the recent municipal ownership campaign the city failed to respond to the direct offer of a program of extensions and improvements made by the Detroit United Railway. This last proposal, it seems to us, was most advantageous to the city. It would have put all the incubus on the company. Detroit, however, has made its choice. It now remains to be seen how well the city will fare in carrying out a program deliberately adopted in the face of experience elsewhere which should have served as a warning. The examples in San Francisco and Seattle meant nothing to Detroit. Of these two it chose to follow the least desirable.

This Is Number One of a Series of Articles on Salient Phases of the Electric Railway Situation

The Trolley Car and the City Man

By Edward Hungerford

EDWARD HUNGERFORD is writing a series of articles on the traction situation for the *Electric Railway Journal*. They are based on intimate, first-hand and recent information obtained on visits to cities in different parts of the country. His keen powers of observation are well recognized, and the editors of this paper are confident that the series will not only prove notable as to interest and readability, but will be of reference value both inside and outside the industry. Mr. Hungerford is well qualified to prepare this series because of his extended newspaper experience as well as because of his acquaintance with electric railway matters from the operator's point of view. After a service of some eighteen years on the editorial staffs of daily papers in Rochester and New York City, Mr. Hungerford joined the Brooklyn Rapid Transit Company in 1904 as its press representative, and this connection continued seven years. Since resuming his work as a writer he has been a free lance in the newspaper field. His contributions have appeared in a number of the popular magazines and many of them have been on railway subjects. In this, the first article in his series for the *Electric Railway Journal* on salient phases of the industry, Mr. Hungerford draws some lessons from recent events in Toledo, New York and other cities. Later articles will take up situations elsewhere. The next article will be on Kansas City.

Said Doherty to Coates:
"Will you do it?"
Said Coates to Doherty:
"I will."

Coates did it. That was the evening of Nov. 8 last. The two men had been in conference in an upper room of the Secor Hotel, Toledo, for long hours that afternoon. The dinner hour had hardly passed before the trolley cars of Toledo began moving silently toward the state line—some twenty miles away. By a little after midnight they were all gone from the deserted town—300 of them; everything on wheels of the Toledo Railways & Light Company except twenty hopeless cripples, which were in the company's repair shops and totally incapable of being moved. The 300 trolley cars—placed tightly end to end they would stretch for more than 5 miles—were interned on convenient sidings of the interurban lines in the adjacent sections of Michigan, and for twenty-seven days thereafter there remained, while that large portion of the population of Toledo which was not able to own its automobiles either paid outrageous toll to jitneys or walked.

No one could accuse Coates, the president of the road, or Doherty, its chief owner, of a lack of courage. Theirs was a genuine *coup d'état*—a stroke so swift and so sure that one is instantly reminded of D'Annunzio conquering Fiume, while great powers slept.

And not alone a swift and sure stroke but one that succeeded—absolutely succeeded. For Toledo, which had quarreled at and with its traction company, suddenly had a bitter taste of the value of a utility to it that until the ninth day of November, 1919, had seemed as much a part of its ordinary work-a-day life as its electric light or its gas, or its police or fire protection, or its food or its water, or even almost the air it breathed.

Suddenly it saw city transport in a new light—saw it as a real fundamental of life itself in a closely builded urban community—realized the hopeless dependence of a city of 275,000 or more upon the trolley cars which morning, noon and night for more than a quarter of a century had been almost part and parcel of its important streets. A few weeks later the important suburban district of Staten Island, in the city of New York, was to come with an equally bitter experience to the same understanding; a few weeks after that practically that entire metropolitan community, foundering and paralyzed under a sudden and unexpected heavy snowfall, was to undergo the same experience, while somewhere between these episodes certain important industrial cities in the eastern portions of Massachusetts were to have totally different but equally enlightening instances as to the genuine value of the humble trolley car to them.

Of these other experiences, more in an instant. For the moment come back to Toledo; consider in some little detail its interregnum of transport. For the proper background—scenic investiture, as the French would say—understand the almost continuous struggle for many years past between various Ohio communities, as well as some of neighboring Michigan, and their trolley companies. The spirits of the late Tom L. Johnson and the late Allen W. Pingree still live, and from time to time mix things up a good bit. Yet some of these communities have made a distinct progress in this situation along permanent and economic lines. Cleveland has one of the very best service-at-cost plans, which has stood successfully the hard test of ten years of operation. Youngstown recently took the Cleveland plan and bettered it, as a permanent solution of its own difficult traction problem. Detroit seemingly is both obdurate and obstinate. And so was Toledo—until recently and the coming of the *coup d'état*. Now it seems as if the very air had been cleared for her; as if she was on the way to a genuine solution of her own traction problem.

"The trouble with Toledo is that she is a cheap town," said a man in a rival Ohio community who had made a considerable study of this whole traction question in the Great Lakes district, "and therefore seeks to solve a pretty big problem in a small, cheap way. There are two different pathways for her. One is to give her trolley company a decent and an equitable rate of fare and the other is for the city to buy its property and run it as an out-and-out municipal enterprise; running into deficit,

certainly, but assuming that deficit for the public weal, as she would the cost of the operation of her schools or her police or her fire department."

Discounting for the moment the Ohio gentleman's description of Toledo as "cheap"—I am inclined to think, after cursory glances at two of her wonderful new high schools, her wonderful city club and her surprising art museums, that she is anything rather than "cheap"—I do believe that he has hit the nail on the head as regards the two paths open to the men who are trying to guide her destinies. I further believe that the second of these would appeal to most of them. But, fortunately or unfortunately, Toledo, like a good many other American communities, is dangerously near bankruptcy. And the purchase of an extensive electric railway company, which while nominally a return bringer in actuality would probably be a deficit accumulator, is at this moment, beyond all doubt, completely out of the question. The most of our American cities today are having hard work maintaining a credit sufficient for them to operate their most imminent necessities. When I was in Ohio a number of its municipalities were besieging the Legislature down at Columbus with demands for city income taxes. Which leaves the average man with the interesting possibility of contemplating not only federal taxes of this sort, and one or more state income taxes heaped above the first comer, but also city income taxes, also varying in number according to the number of cities in which he might be living or doing business.

So it would seem that Toledo's only way out was in the readjustment of its trolley fares. In fact it is this very step toward solution that has embroiled the City Hall with the trolley company's headquarters for nearly nine or ten years past.

For a good many years the Toledo Railway stuck by the 5-cent fare with universal free transfers just like most of the other city tractions all the way across the land. In addition it sold six tickets for a quarter and, for a short time only, workingmen's tickets at 3 cents each. These last were good for only two hours in the morning and two in the evening, and the practical operating difficulties in holding their use to the four specified hours was a large factor in their discontinuance.



Behind the smiles of Frank R. Coates and Henry L. Doherty is a serious desire to give Toledo fine railway service.

But the 3-cent idea had been bred in the minds of the city politicians. They began more and more to insist that this be made the standard figure throughout the city, at all hours and with the universal free transfers continued as part of the system. This despite the fact that the figures of their own experts showed that the actual operating expenses of the road, to say nothing of the necessities of its stockholders, even then precluded even the faint possibilities of 3-cent fares.

But what are statistics to a City Hall crowd, anyway? Figures lie—when Aldermen rule that they shall lie. And so it was that as far back as March, 1914, the Toledo City Council suddenly passed an ordinance fixing the local fares at 3 cents and advised Toledoans to pay no more. In fact the Council went so far as to promise police protection to folk who were threatened with ejection from the cars after tendering the 3 cents which it had blandly declared legal fare.

Now what did the company do in this situation? Did it try to fill its rear platforms with thugs or threaten then to suspend its service entirely? It might have done either, and still have been entirely human. But it did neither. It merely put the case squarely up to its patrons in a series of posters and newspaper advertisements that if they did not wish to pay 5 cents they could tender 3 cents—and then ride free.

And what did the patrons do? Let me haste to record the answer, lest you gain the impression that the Ohio man who called Toledo a "cheap town" was right:

Eighty per cent of the company's patrons paid their 5-cent fares and rode—in company with the satisfaction of their consciences. The other twenty per cent tendered 3 cents, which was promptly refused, and rode free—also in company with their consciences. Which, I think, of itself is something of a commentary on American individualism in actual day-by-day practice, and a fair to middling test as well of the real

recognition by the individual man of the value of the trolley car to him. The politicians do not always accurately interpret his real state of mind.

The Federal Courts Step In

For some weeks this anomalous situation, where conscience was the fare register, continued. Then the United States courts upheld the trolley company, which had applied to them for relief, and 5 cents became a matter of regulation and not of individual decision. But the clamor of the City Hall was by no means appeased or silenced. No matter what decisions the federal courts might bring forth, it held a trump card in the fact that the term franchises originally granted to the Toledo Railway expired very early in that same year of 1914. Since that time it has operated the streets of its community purely on the basis of public necessity and without franchise rights of any sort whatsoever —a day-to-day agreement it is called —but the so-called agreement is hardly worth the paper upon which it is written.



A reminiscence of Toledo's eventful carless days when the railway rolling stock reposed peacefully in Michigan.

Last June ex-President Taft's War Labor Board expired after making numerous and sweeping raises in the pay of street railway men across the land. Toledo shared in these increases; the platform men of its street railway, in particular, receiving large, and for the most part justified, increases in their pay envelopes. But the large increases in the pay envelopes of employees made a sizable deficit in the company's daily operating balances. And it quickly moved to a readjustment of its fare schedules to keep pace, in part at least, with the large readjustments of its payrolls. It raised its local fares to 6 cents, with an additional charge of 2 cents for each transfer.

Close upon the heels of this step the Toledo City Hall moved. It passed an ordinance to remove the Toledo Railways & Light Company from its streets—to end abruptly the informal day-by-day agreement—and having passed the measure in its council chamber sent it to the electorate at the November election, in accordance with the workings of the initiative and referendum law of Ohio.

The local politicians had no intention of actually removing the trolley company from the streets. Oh, no, they were far too shrewd for that. They anticipated just what a storm such a radical step would bring, those politically wise old boys of the city by the broad Maumee. They would get the ordinance approved on the referendum—that would be easy—and with that approval sealed and certified they would have some little big stick to hold over the trolley folks. If they were not good, down would come the stick. But the trolley folks would be good. The Councilmen knew that. Councilmen almost always have the wisdom of super-Solomons.

The intelligent electorate of Toledo on Tuesday, Nov. 4 last, approved the "ouster" ordinance by a decisive vote—I might easily add, "of course." Why did they do it? Search me. Why did the intelligent electorate of metropolitan New York turn down John Purroy Mitchel and elect John F. Hylan their Mayor? Or Milwaukee reindorse Berger? Or——

But this is not a treatise on municipal politics. This is merely a statement of some rather vital dramatic facts in regard to the traction situation across the land. And as such a related fact comes the decisive vote of the citizens of Toledo on Tuesday, the fourth day of November, 1919. And Henry L. Doherty, the oil and traction man of New York, who numbers this railroad among many other properties, closed his desk in a small but very busy street in downtown Manhattan and hurried out to Toledo. There he sat with his Man Friday—Coates, the big framed and big minded president of the company—for three days more and awaited the formal receipt of the election return.

It came—with pomp and gusto from the City Hall, which forwarded it at once to the trolley company's headquarters. Coates hurried it to Doherty, in the hotel across the way. Doherty read it slowly; read it twice. Then the corners of a naturally humorous mouth began to rise.

"Will you do it?" he asked.

And the lieutenant replied with the remark quoted in the first part of this article.

Toledo, with all her great growth, has not yet progressed so far toward metropolitanism that Saturday night downtown has ceased to be a locally beloved institution. And a Saturday evening early in November, with the weather still holding a little of the mildness of autumn, sees the busy length of Jefferson street and other important downtown thoroughfares well crowded with shoppers, theater patrons and the like. The second Saturday of November last was no exception to the rule. The trolley cars—Cherry and Long Belt and Short Belt and all the rest of them—were working their way homeward well laden with tired folk. And there must have been another of those fall-time dances down at the Yacht Club. The folk who lived down on the road to Toledo Beach saw a pretty steady bound procession passing them toward that popular resort.

As the evening crept on there were

fewer of the cars. The runs became further and further apart. Gone into the barns for the night, you surmise. On any ordinary night—yes. But this was an extraordinary night in Toledo's history. The crews whose runs ended in the early evening and who reported with their cars at the barns to turn them in and get their time found that the day's work was not yet over. There were special runs on that night—at least so it seemed. Orders were curt and unexplanatory.

"Take no passengers and report to inspector at Cherry Corners," read half of them. The other half were equally unsatisfactory save that they sent the empty cars to the inspector at the corner of Cherry and West Central. Both of these men were veteran employees of the company—accurate and close mouthed. They had verbal orders as to what to do with the cars which began reporting at intervals of five or ten or fifteen minutes.

An empty trolley car marked "Special" in the streets of any large city is not a particularly noticeable thing. But a long string of them begins to be. And late that evening the telephone began ringing in the offices of the Toledo morning papers. The curiosity of the folk down on the road to the beach had been aroused. What sort of an affair was that going on down at the Yacht Club, anyway? Judging from the number of the cars that had gone down there to bring the crowd home, it could hardly be anything smaller than a state political convention. The city editors consulted their little news calendars, confirmed their suspicions by their telephones. There was nothing on that evening at the Yacht Club. The place had been closed for the season more than a fortnight.

The city editors swore great editorial oaths and speeded their nimblest reporters over to the trolley company's offices. The big street doors of the building were closed, and when a sleepy watchman answered to their pounding he said that they could come at eight o'clock on Monday morning and pay their light bills. More oaths. Desperation. Then reportorial ingenuity. Then reportorial eyes fell upon an ancient hotel the windows of whose upper floors looked into the lighted windows of a single floor of the darkened trolley building, windows which the news getters knew gave to the offices of the president and the general manager of its energies. Up to the fourth floor of the old hotel—rent those rooms, for a night, for a week if necessary, shrieked reportorial ingenuity. One of the Toledo scribes had taken his wife to a show earlier that evening and made the lucky find of opera glasses in his overcoat pocket, which came into quick use.

It needed no opera glasses, however, to show Coates in his office—big of body and brawn, shirt sleeved, an unlighted cigar in his teeth—at his desk and telephone, tremendously busy about—something. And taking no notice whatsoever of the wild gesticulations of his newspaper friends in the hotel window across the way. After a time Coates did seem to see them. He came to his window and beckoned to the street door of his building. There he met them. It was just a very few minutes past midnight.

"I think that we will call it a day's work," said Coates.

"What as a day's work?" asked one of the scribes.

"We have taken the people of Toledo at their word," was the reply. "There is not an able-bodied trolley car left in this city."

Then he fell to telling them of the evening's work, of the careful plans that had made so daring a *coup d'état* possible, without a single soul becoming aware of it; how the cars that had been sent to Cherry Corners had been ordered on by the inspector there to Toledo Beach; those to Cherry and West Central on to the Toledo & Western tracks. Orders had been veiled and most secret. Few chances were taken as to the thing leaking. And the cars, having hit these two interurban tracks leading out from the town, were already safe in Michigan—and would stay there until the people of Toledo who had ordered them out asked them back again.

As a matter of recorded fact it was just 1:40 o'clock that Sunday morning when the final bunch of cars pulled into the Toledo Beach terminals, had the trolley poles carefully removed and hidden—Coates proposed to take no chances with a mob movement of the citizenry of Toledo going out there and bringing the cars back by main force—with the drawbridge that crossed a small creek between them and the town opened and spiked open. The crews had to be brought back on work trains. And it was 6 o'clock on the Sabbath morning—dawn in trolleyless Toledo—before it was really a day's work ended for Coates and the big president of the trolley company went home to a well-earned rest.



When Toledo's cars went "on vacation" every other type of vehicle was pressed into service.

Jitneys Try to Do the Service

Toledo had little rest out of the situation. The city authorities who had put it into such a mess made strenuous efforts to replace the trolley service with jitneys of every sort and description, but with pitiful results. They appointed a traffic manager for jitneys and abolished the

charge for licenses for these, practically all traffic regulations as well. In response to these appeals, some 1,500 cars, of every style, vintage and description, appeared. They advertised routes—and then did not stick by them. On the contrary, they showed no disposition whatsoever to leave the "good streets," where traffic awaited in large and profitable volume, for "lean" ones, which needed transportation service and in the days of the trolleys had it. They ran in routes and hours such as pleased their drivers, and for this vastly inferior service Toledoans were glad to pay anywhere from a dime upward.

In the meantime the federal courts, acting under the inspiration and keen judgment of Judge John M. Killits, were working to end the intolerable situation. The cry of "overcapitalization" was raised by the local newspapers. The trolley company suggested a valuation of its property. But the City Hall whined a protest that it lacked the money to take this step. The trolley company offered to put up the $25,000 for it. But still the City Hall declined. Yet Killits persisted—the situation daily grew worse rather than better—and Toledoans faced a holiday season of vast trade losses, as a direct result of their own stupidity and shortsightedness.

Finally the truce was struck. Toledo had learned her lesson. Like a good sport she took her medicine. With Judge Killits as doctor and nurse she gave the trolley company its increased fare—6 cents, with a charge of 2 cents for transfers—and today is preparing a permanent agreement based on that which has worked so successfully in Cleveland and some other Ohio cities, and realizes, as perhaps some less-favored communities fail to realize, the value of the trolley car to her householders. If she really does that, perhaps the lesson has been well worth all that it has cost.

Condition Is Serious in New York Also

If I have treated a really dramatic incident in our American municipal history with the journalistic touch, please do not think that I am for a moment overlooking its tremendously serious aspects. There was not a day in the following twenty-seven that the average thinking Toledoan did not come to realize just what the trolley car meant to his health, his happiness, his comfort—and his pocketbook. I think that here is a thing that a good many of us Americans completely overlook. In the long years that I owned a house in an outlying district of Brooklyn it used to be a simple enough matter to step over to Flatbush Avenue for the morning trolley car into town and to curse out our own trolley system on those unfortunate winter days when the cars came all too rarely, in bunches, or, for hours, not at all. Then came a winter's day when they came not at all—all day long. A severe and unanticipated storm had caught the Brooklyn Rapid Transit napping and had completely covered its rails with several inches of ice and hard-packed snow, with the result that for forty-eight hours we had no trolley service whatsoever, and would have fared badly indeed if it had not been for the neighboring elevated railroad, which picked up a huge burden of overload traffic, ordinarily carried by the trolley cars.

On a day early in February I went from New York to a small city on the west bank of the Hudson River. It is reached by the West Shore Railroad, but in winter is not easily accessible by the New York Central. So therefore I had a small trunk and the necessity of reaching the West Forty-second Street ferry from the Hotel McAlpin, at Thirty-fourth Street and Broadway. The trip, hardly two miles, took nearly two hours. The severe storm of Feb. 5 had found an inefficient city administration sound asleep and so had all but completely paralyzed the street traffic of the largest city of the Americas. When one traveled one rode in taxicabs if one was lucky to find them, and paid fearfully high prices for bumping over ice-clad streets. The street railways? Alas, they were not available even for folk without trunks. They had made little headway against the storm—although in other years I had seen them conquer even greater ones—and after a few feeble attempts to battle against it gave up completely and suffered their rails to be covered and their trolley slots to be filled and clogged with ice which could not be removed, save by hard hand labor.

In those other years, however, the surface railways of Manhattan were still "going organizations." They had pride and pep in their service; the sort of thing that in the days of the war we learned to call morale. Three years of bickering and conflict with a city administration without any constructive policy of its own, but merely a desire to make political capital at every turn by the simple, and not original, processes of swinging big clubs and emitting great shriekings, had robbed our surface roads in New York of their last vestige of morale. They had lost heart and hope. They no longer cared. It was easier to quit than to struggle. And quit they did. While a great metropolitan city could thank each and every one of its lucky stars that it possessed a fairly complete subway and elevated railroad system. Without these it would have had to shut up shop completely.

As it was it has had to pay a great price for its own neglect and stupidity—according to the amateur statisticians some five million dollars a day—and is not yet done paying the bitter price. I rode from the McAlpin to the West Forty-second Street ferry, which boasts no subway or elevated railroad connections, in a taxicab and paid $5 for the ride. The taxi driver earned every cent of his fare. We swerved through ruts and sank into deep holes. Second speed was the best that we could do. Once, in order to get around a truck blockade that had lasted for almost three hours, we rode for a space upon the sidewalk, and reached the ferry-house in time to miss the train. It had taken us more than an hour and a half to traverse less than two miles of city streets.

Yet my loss, time and disposition and taxi fare, was as nothing compared with those of the business houses of New York. The repair bills alone to trucks of every sort in New York during February, 1920, must have come to astounding totals. Every garage in the community ran its shops night and day continuously and then found itself far behind the work offered to it. There was a shortage of spare parts, of tires, of gasoline. I do not believe the five million dollar guess the least bit of an exaggeration—not when one comes to consider the aggregate of loss in time to a whole cityfull of folk.

Yet, as I have just said, Manhattan Island had the benefit of a complete subway and elevated railroad system which never ceased to function for a moment, either during the storm or after it. Staten Island is not equally fortunate in her rapid transit facilities, and when, a few weeks before, the Midland Railway Company, which renders almost the sole transport service to a large and well-populated section in the center of that small borough, found its appeals for fare relief utterly ignored by the city authorities and so was

forced to suspend its service completely the commuters who had builded their homes along its lines in the hope and promise of at least adequate transportation facilities were left stranded. Apparently that hope and promise have meant little or nothing to the New York City Hall. Mayor Hylan sent a few of his trolley-breaking motor buses down to Staten Island, but the attempts at service that these rendered were so pathetic as to have been laughable were they not so tragic. The jitney drivers not only commanded such prices as the traffic would bear but, in the face of one of New York's heavy winters, ran when or where it pleased them, while the Staten Islanders begged for a return of their trolley cars—at a 10-cent fare if need be. The company had only asked for 7 cents.

What Massachusetts Has Done

One other group of instances of what the trolley car means to the city man—and I shall try to draw one or two definite conclusions: Down in New England, where for a long time past living and wage conditions have been exceptionally high, the lines of the Eastern Massachusetts system—formerly the Bay State Street Railway—have had hard sledding indeed. In fact if it had not been for the action of the commonwealth in stepping in and practically guaranteeing the operating costs of the road, in a fashion similar to that of the city lines of Boston, I doubt if this system would have been able to keep its cars moving at all on a good part of its lines. It matters little that a good many of these were badly planned and placed; should never have been built at all. The kernel of the nut is that they have been built and operated continuously for a goodly term of years. And upon the predication of the continuation of such service men and women have gone out upon these lines and there built their homes. The question of fares is a secondary matter with most of these. The Eastern Massachusetts lines are today charging 10-cent fares, which seems to be regarded as a sort of maximum possibility for street railways, even in these extravagant days. And there has been comparatively little protest from folk who have had any real understanding of the situation.

The vital factor with these home owners is the continuance of the service; they feel that with efficient state regulation the fares will be held to a basis of decency at least. Jitneys will not do. Not only are there the service uncertainties of an unorganized business but the New England winters are ill suited for the operation of automobiles, particularly through the roads of the open country.

Yet upon jitneys the Mayors of at least four important industrial cities of eastern Massachusetts began to pin their faiths. Not that they had any particular love for this form of transportation, but, like the ouster ordinance of Toledo, it formed an admirable big stick to hang on the wall and, school-teacher fashion, to be pointed at from time to time. So it was in Salem, in Lawrence, in Lynn and in Brockton—some other nearby towns as wel'—the jitneys, winked at by the politicians and taking a keen commercial advantage of the raised trolley fares, began multiplying in great numbers.

The trolley folk watched this situation with an ill-disguised impatience, and in the case of Lawrence took a decisive step on the day before Thanksgiving, 1919. Whether there was any significance in choosing such a holiday time I do not really know, but the fact remains that for that day and Thanksgiving Day itself the many lines of the Eastern Massachusetts in and through Lawrence suspended service entirely. And like the motorless Toledoans the motorless Laurentians either rode in a miserably inadequate jitney service—or walked. In either case they suffered almost equally great inconvenience. For during both days it rained steadily and heavily. And within forty-eight hours the City Council was brought to the passage of a stiff ordinance regulating jitneys; classifying and limiting them to streets or routes not used by existing trolley lines. Upon the assurance of the passage of this ordinance the trolleys resumed operations and Lawrence breathed more easily.

Salem was a more refractory subject. On December 18, a fear-



Transportation under some difficulty on a Massachusetts electric railway last winter

fully cold day, with the average temperature at a bare 4 deg. above zero, she, too, in company with the adjoining communities of Peabody and Beverly, either walked or shivered in her beloved, and unheated, jitneys. The trolleys were completely withdrawn from the streets of all three towns, while their retail merchants, fearful of the almost total ruination of their Christmas shopping trade, besieged the Salem City Hall, with the definite result that before night the municipal authorities promised the enactment of a fair but restrictive jitney ordinance, and at once began the revoking of existing jitney licenses, which, in turn, meant the resumption of trolley service upon the morrow.

But Salem did not keep her promise. She juggled with it, politically. She toyed with a referendum election, stood politically first upon one foot and then upon the other.

The City Hall powers seemed to look with kindly eye upon the jitney drivers, until the exasperated trolley folk again were forced to suspend their service—this time in Salem alone, but for three bitter, stormy January days, the fifteenth, the sixteenth and the seventeenth. Heaven seemed to be in league with the Eastern Massachusetts in its fight for the square deal in each of its *coups d'état*. On the last of these three grinding days the Mayor of Salem took a train and went into Boston—went straight to the State House and into the office of the Governor. With a fine show of enterprise he demanded that the trolley cars be started—forthwith. The street railway company—remember, if you will, that under its system of trusteeship it has become to all intents and purposes a state-operated concern—put forth a few facts in rebuttal in regard to the jitneys.

The Attorney-General of the commonwealth sat close to the Governor's elbow. To him the chief executive turned:

"Are those jitneys in Salem running legally or illegally?" he asked.

The Attorney-General did not hesitate.

"Illegally," was his instant reply.

The Governor's jaw snapped shut. He is Coolidge—the same Governor Coolidge who occupied a fairly important role in the settlement of the Boston police strike last autumn.

"If Salem can't stop them, I can," said he quietly.

And, turning to his telephone, he ordered the chief of the state police into Salem on the next day. The troopers moved in there promptly. They found the trolleys all in normal operation again—in accordance with a request of the Governor—and the jitneys up to their old practices, running along the street car routes and underbidding them in fares. But only for a short time. Without fuss or feathers or any commotion whatsoever the state troopers moved. They cleared the Salem streets of these buses. They have not since returned.

Service has not been suspended either in Lynn or in Brockton. In the latter city a mere posted notice saying that continued refusal of the city authorities to co-operate would bring about a total cessation of service on a certain designated day was quite sufficient of itself. The Brockton City Hall co-operated—at once—as finally the Salem and the Lawrence City Halls had come to the same sage decision. But one shudders to think what might have happened if the Eastern Massachusetts had been just a plain old grubbing private traction system, instead of a state guaranteed—and protected—service institution. I think, myself, that each of these towns would have had Toledo all over once again, with the probabilities that the combination of sullenness, misunderstanding and the hardest winter that New England has known in thirty-six years would have brought a suspension of trolley service for nearer forty-seven days than twenty-seven and with all the consequences that would certainly come with such a complete breakdown.

Montreal's Development Promoted by Electric Transit

When the Canadian Northern Railway audaciously accomplished the impossible—a railroad entrance into the very heart of Montreal, by piercing a 2-mile tunnel under Mount Royal—it anticipated some future possibilities of its step by buying some thousands of acres on the north side of the mountain, directly across from the closely builded city side. These acres showed, mutely but unmistakably, what transportation means to the modern city. They were open acres indeed—fine fat truck farms and orchards, with here and there a 200-year-old cottage of a habitant showing itself—yet within 2 miles of the very heart of the greatest city of imperial Canada. In every other direction Montreal stretched herself, 4, 5, 6 and 7 miles. In that one the mountain stood, a seemingly impassable barrier to further development.

The Canadian Northern Railway folk, deciding to undertake the herculean task of tunneling Mount Royal because they needed downtown freight and passenger terminals in Montreal for their through traffic, foresaw the inevitable results of transportation through the mountain upon those self-same truck farm acres. Overnight they would rise in value, might double and redouble and redouble again. While the railroad itself would merely have the cost burden of the tunnel on its hand, to be distributed as best it might be upon its long-distance traffic. With that foresight as a guide it reached out and bought those truck farms and orchards, and decided that the benefits that would accrue to them, by reason of direct high-speed transportation, should be translated into dollars that would repay the greater part if not the entire cost of the tunnel and the terminals.

I wonder, myself, why there have not been more instances in this country of a more direct connection between city transportation development and the certain development of real estate values that follows in its train. There have been isolated instances where this has been done—in a more or less indirect way. But on the other hand all too many instances where the trolley road or its big brother, the steam railroad, has starved while the real estate operators and the land-owning public generally have grown fat and rich at its expense. These are matters of record. They are indisputable. And it is just as indisputable that it is the expert real estate operator who realizes the most keenly the real value of the trolley car to the city man, who generally is the most active in trying to bring about co-operation with it, as well as a constant extension of its facilities. It is he who most quickly translates trolley service into assessed, or real, valuations.

Transit Is a Necessity to the City Dweller

I bear no briefs or cudgels for the trolley companies across the land. I know where some of them have sinned, and have sinned grievously, but I feel today that there are more of them that are sinned against than sinning. From wine and cakes they have come to stale water and to husks. They have lived to repent most seriously of earlier sins, of omission as well as of commission. While the opprobrium which they have brought upon their right-minded and right-actioned fellows of the traction world is not to be counted as the least of their shortcomings.

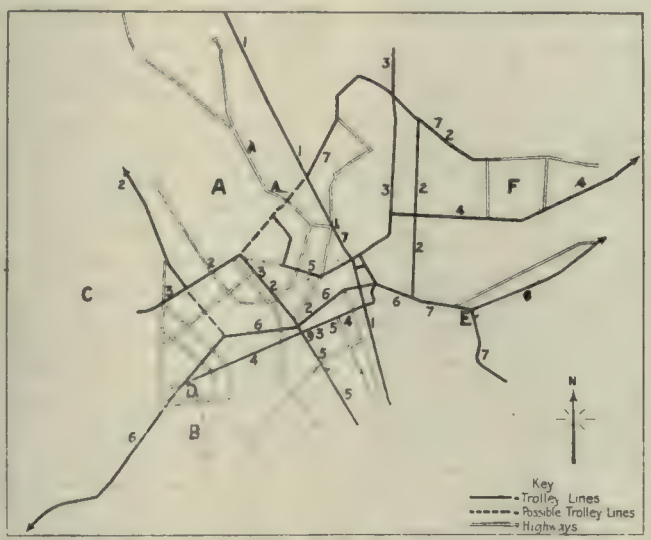
But this is not the hour for recriminations. The point that I am trying to make is that the soul or the conscience of a street railway has nothing to do whatsoever with the dependence of the householder upon its service. It may be the blackest of organisms. But to the man who lives upon its line it is a daily necessity—almost as his light or his water or his food or air itself. His health, his comfort, his happiness—the daily ordering of his life as well as the mere commercial value of his house and home—are vitally dependent upon it. Here is the rub. Here, it seems to me, is the pre-eminent and vital guiding principle that the City Halls of Toledo or New York or Salem or Lawrence or any other widespread and well-built American community can hardly fail to ignore.

The Place of the Bus—III

American Conditions, Under Which the Bus Is Preferable to the Car Despite Higher Cost of Operation and Consequently Higher Rate of Fare

BY WALTER JACKSON
Consulting Engineer

IN opening this study attention was directed to the extensive development of motor bus services by British tramways in co-ordination with their transportation on rails. No such extensive development exists as yet in this country, although the pioneer installation of buses by electric railways for the feeding of interurban lines was made as early as 1915 by Stone & Webster interests in the State of Washington, and even before that by certain city railways which wanted to obtain a first-hand idea of the cost of jitney bus operation. At first thought one would suppose that the thousands of individually operated jitney automobiles and jitney buses, which became so unpleasantly prominent about 1914, would have demonstrated where the superiority of the trackless vehicle does lie. However, as has already been shown, it is a lot easier for jitney drivers to travel in the old railway rut and to steal traffic than it is to break a new path and to create traffic. It is the exception to find a jitney operator habitually taking a short cut or driving around instead of through a congested district. Far be it from him to keep away from the thoroughfares where traffic is heaviest and to persuade the public to walk one or two blocks to patronize him.



THIS IS A MAP OF THE CITY CITED AS CASE 3 AND SHOWS EXISTING CAR LINES AND ROUTES PROPOSED FOR BUS AND RAILWAY EXTENSIONS

Yet there is more than abundant proof that the one way to use the motor bus in the manner most beneficial to the public is to operate it in conjunction with the car service, but with as little duplication and overlapping of routes as possible. Necessarily, this implies operation under one management if not one ownership.

WASHINGTON BUSES AVOIDED NEEDLESS INTERURBAN FEEDER TRACK

The experiment of Stone & Webster and the results thereof may be summarized as follows:

Edmonds—Seattle Heights route, 3 miles long over unpaved highway and steep grades. Population of Edmonds, 1,600. Object: To connect with Pacific Northwestern Traction Company. This line had to compete with a private bus service giving direct service between Seattle and Edmonds, and with the Great Northern, giving through service between Edmonds and Everett, also on the Pacific Northwestern. Service was discontinued after sixteen months. During the operating period of June, 1915, to September, 1916, there were operated 33,657 bus-miles with gross earnings of $1,272.43, which gave the hopelessly low intake of 3.78 cents per bus-mile.

Auburn—Enumclaw route, 21 miles over a route unpaved at first and which included steep grades. Population of Enumclaw and intermediate town of Buckley, 3,000. Object: To connect with electric trains at Auburn, such connections not being provided by the independent operators. Service discontinued after seventeen months. Monthly earnings of $661 to $1,177 failed to meet the cost of service.

Puyallup—Orting route, 10 miles long over paved highway with moderate grades. The company operated with buses withdrawn from the Auburn-Enumclaw route. Object: To connect Orting with the interurban railway at Puyallup, but in competition with through bus service to Tacoma, the destination of many riders from Orting. Competition and the small amount of traffic made profitable operation impossible. During the eight months of service there were operated 59,879 bus-miles whose takings averaged only 6.24 cents per bus-mile.

The lesson to be drawn from these unsuccessful efforts to tie bus and interurban together obviously is that no such form of transportation can be successful if there are not enough customers to go around, if competition is unrestricted and if the direct bus service is preferable (whether from a time, money or comfort standpoint) to the use of two kinds of transportation. The amount of traffic carried did not justify the service, even after the bus is credited with bringing some patrons to the interurban. At the same time, if the bus did not make any money for the railway it had the important, though negative, virtue of preventing it from losing far more on the construction of a track and line for the distance under consideration.

It is also clear from these experiments that so long as irresponsible, free-for-all competition is permitted the public will not enjoy that reliability of service and liability for accidents which are possible only through an established transportation undertaking.

The fourth, and surviving, route served by Stone & Webster interests is of entirely different character, its purpose being to afford a through bus service between Seattle and Bothell, a distance of 16 miles over well-paved highways. This line was opened in November, 1915. Up to June 26, 1916, it had to compete with a five-car company, but by Oct. 10, 1916, the last jitney operator had disappeared. The Seattle-Bothell route is an example of a clean-cut bus line from a large city to rather distant outlying communities which have no electric railway service.

A significant fact is that few users of this route took advantage of the 5-cent fare and free transfer privilege which would have enabled them to save money on the 5 miles (Cowen Park and city depot at Fifth and Pine Streets) within Seattle. Consequently, the

inter-line arrangement with the Seattle electric railway, then under Stone & Webster management, was canceled Aug. 1, 1917.

This is in accord with much British experience. Most of such passengers from outlying communities desire to reach the heart of the city as quickly and as conveniently as possible rather than go through the bother of transferring from one vehicle to another at the terminus of the trolley line. Where a higher rate of fare is charged on the bus than on the car—a procedure necessary in any case—the bus will not be slowed down too much within the city through use by short-ride passengers, while the facilities remain available for the out-of-town riders for whom the buses were specifically installed.

California Buses in Both City and Interurban Work

In 1917 the question arose whether the San Francisco Municipal Railway should build certain track extensions into sparsely settled territory or go to less expense by developing these districts through bus extensions. It was decided to install buses, of which six White nineteen-seaters were purchased for the following services:

Route No. 1, two buses, for transfer to and from "A" line, twelve-minute headway across Golden Gate Park for which a trackway was quite inconceivable in any case. Maximum ride possible for 5 cents 6.88 miles, made up of 4.8 miles on trolley and 2.08 miles on bus. Passengers carried April, 1918, were 632,664 on car and 34,654 on bus, a ratio of 1:0.054; bus riders during 1918, 367,751.

Route No. 2, one bus, for transfer to and from "B" line along Great Highway (ocean shore), fifteen-minute headway. Maximum ride possible for 5 cents 8.18 miles, made up of 7.06 miles on car and 1.12 miles on bus. Passengers carried April, 1918, 754,245 on car and 14,346 on bus, a ratio of 1:0.019; bus riders during 1918, 159,511.

Routes Nos. 3 and 4, three buses connecting with "K" line on Ingleside and Parkside routes (which had been combined to reduce losses), ten-minute headway. Maximum possible ride for 5 cents 7.74 miles, made up of 6.04 miles on car and 1.70 miles on bus. Passengers carried April, 1918, were 165,741 on car and 50,089 on bus, a ratio of 1:0.31; bus riders all of 1918, 496,036. (Discontinued April 12, 1919. Later figures will be given in the article on costs.)

The comparative speeds of cars and buses were: For nineteen-seat buses operating in sparsely settled territory 12.5 m.p.h.; for cars of more than twice the seating capacity, operating through the congested district in part, 9.4 m.p.h., including layovers. The writer figured at the time that each bus rider was subsidized to the extent of 2.1 cents per month, a loss which naturally has risen since. However, it is perfectly plain that the loss would have been greater if this thin traffic had been handled by means of a trackway. A bus service like this can be made self-supporting only by a transfer charge or modified zone fare.

Late in 1916 the Pacific Gas & Electric Company installed some twelve-seat buses on 1 and 2-mile extensions in Sacramento purely as an accommodation, as there was no profit in serving the sparsely settled districts that had asked for transportation.

The Pacific Electric Railway, operating in a state which has had a tremendous development in long-distance busing, has given thought to the motor bus as an auxiliary for both its city and interurban railways. Thus in 1916 it built at its Los Angeles shops two thirteen-seat one-man pay-leave buses with 30-hp. automobile engines to serve Arlington Heights, a Fresno suburb of 3,000 population. In this instance, also, passengers are carried in buses only from the terminus of the railway routes. In 1917 it was announced that the company was building thirty-seat buses for the same service. Permits were also received to operate buses in San Bernardino County. In a recent statement the president of the company declared that its bus operation had not proved financially successful. Detail figures bearing out this statement will appear in a later article.

Bridge Connection at Dubuque and Crosstown Link at Ft. Wayne

Coming eastward, we find that on Sept. 4, 1914, the Union Electric Company, Dubuque, Iowa, installed a bus service over a 2200-ft. bridge to East Dubuque, Ill. (then "wet" territory), a community of 1,500 population. The round trip is about 3.5 miles. The fare is now 7 cents, or four tickets for 25 cents, and the service is entirely independent of the local street railway system as regards transfer privileges and the like. The fare includes a bridge toll of 1 cent per passenger. Two fifteen-seat gasoline buses are now used on a fifteen-mile headway, with one as spare, for since prohibition came July 1, 1919, traffic has dropped from 85,000 to 38,000 a month!

The crosstown link bus service installed by the Ft. Wayne & Northern Traction Company at Ft. Wayne early in 1917 was the result of a request from residents in the Bloomingdale district for connections to electric lines which were only 1 mile apart. This bus route was established, therefore, partly to please the patrons of the company and partly to determine the best route for an eventual crosstown trackway. The route connects the two railway lines at points about 1.5 miles from their repsective suburban terminals. Four sixteen-passenger buses were purchased, but only two were used regularly, the others being kept as reserve. Operation was conducted for eighteen hours a day. The fare was the same as on the cars, namely, at that time, six tickets for 25 cents, including the transfer privilege. Ft. Wayne's present rate of fare is 6 cents. During the last ten months of 1917 the buses ran 93,012 miles at a cost per bus-mile of 12.084 cents.

A somewhat similar bus service was inaugurated in 1918 by the Winnipeg Street Railway for 1.2 miles on Westminster Avenue, between the terminal of one line and a feeder connection of another. (See ELECTRIC RAILWAY JOURNAL, May 1, 1918.)

Baltimore's Bus Service Indicates Possibilities of Congestion Relief

The University Parkway-Charles Street (2.63 miles) bus service of the United Railways & Electric Company of Baltimore has been discussed so extensively and competently by L. H. Palmer, assistant to the president of that company, in his paper before the 1919 convention of the American Electric Railway Association (ELECTRIC RAILWAY JOURNAL, Oct. 11, 1919) and in the ELECTRIC RAILWAY JOURNAL for Jan. 3, 1920, that it is necessary only to remind the reader that because this service is run by the railway itself (through the Baltimore Transit Company) overlapping can be reduced to a minimum. Furthermore, with the assurance that jitneys would not follow the car tracks this and future bus service could be routed from the viewpoint of affording alternative routes to and shorter routes than the street railway. At present both the cars and buses are operated at a 7-cent fare. Experience abroad, and here as well, indicates, however, that people will pay a higher fare on the buses if the latter can offer noteworthy advantages in speed because of long non-stop runs. This is not yet

the case in Baltimore, but doubtless will be when the company can treat its problem as a whole without worry as to jitney interlopers.

Within the limits of this article it is not practicable or desirable to list all the cases where electric railways have instituted bus services either directly or in co-operation with realty development companies, manufacturers and other parties, but one may say confidently that to-day both roads and vehicles have improved to the point where requests for service to thinly peopled districts can be best and most cheaply satisfied by the installation of the motor bus. From an account of what electric railways have done it is now logical to pass to a review of some of the things that they have not done but ought to do in this field. As examples, the writer will discuss three different situations with which he has been personally connected:

Forcing the Public to Improvised Motor-Truck Buses

In City No. 1 the electric railway had asked for an increased fare. The prevailing rate of fare was actually below 5 cents and one would have been inclined to recommend an increase out of hand. Unfortunately, the company could not show that it had been trying very hard to reduce its operating expenses or to pick up a lot of traffic that was literally begging to be carried. With a population of less than 100,000 it could not show a single safety car, and its general attitude on that subject might be summed up by the phrase, "Give us the increased fare now, and then we'll see if there's anything in this kind of operation."

The city had been growing beyond the terminals of the city railway for distances varying from ¾ to 2 miles, largely through the establishment of big factories. The company could not raise the money to build extensions to serve these districts, as its operating figures showed a loss on the average length of ride already being given. Nevertheless, the employees of these new plants had to have some form of transportation. To meet this need, several of the factories started an auxiliary service for employees, using motor trucks fitted with benches, which were removed when the trucks were used for their other job of carrying material. Because of the inadequacy of this service the workers have little temptation to settle in cottages on the cheap land near the factories. They naturally prefer to live in town in order to be near the stores and center of amusement life.

As one result, the community had reached the point where it was quite ready to install a bus system indiscriminately and to let the railway die with all its imperfections and antiquated cars. The writer's investigation disclosed that an all-bus system would be far too expensive. What this community did need primarily was safety car operation for almost all the mileage, except that some of the big cars could be retained for rush-hour service after automatization with pneumatic door and step control, and, secondarily, it needed a few modest bus routes until the building up of the factory suburbs would justify track extensions. For this particular situation through bus routes into the city at a special fare were not desirable because the extensions were so short that the greater part of the run would be in direct competition with an underloaded street railway. Also when the bus services were confined to the comparatively short extensions fewer buses would be required; nor would it be necessary to use an elaborately equipped vehicle for ten-minute rides.

The proper plan appeared to be to charge an increment of say 2 or 3 cents for the ride between the street railway and bus terminals. This increment might be paid by manufacturers because of their being relieved of the costly and unsatisfactory use of motor trucks for passenger service. Similar arrangements covering car rides are actually in practice at Racine, Wis., and also on the Connecticut Company's line, since the coming of the zone fare. At Racine a factory on the outskirts pays directly to the railway 1 cent extra for every employee passenger entering or leaving via the turnstile station at the plant. In Connecticut a number of employers are making up for six months anyway the difference between the old 6-cent fare and the new 8-cent, 10-cent, etc., zone fares.

City No. 2 represents one of the growing number of cases where the congestion of certain car routes offers a tempting morsel to the bus promoter. In this instance, while the bus promoter was rather grieved that he was not permitted to run on the busiest street of the city he had the faith that there were enough good sports in the community to pay a double fare for the sake of enjoying a seat and more ozone. Here was an example of failure on the part of the electric railway to institute a bus service itself for the sake of relieving some lines and rerouting others. There must be necessarily a great difference between the policy of an independent and of a co-ordinating bus system. The independent company naturally wants to lap the cream of the railway traffic without regard to how such lapping will affect the finances or traffic currents of the railway, whereas operation of the buses by the railway can be helpful to the railway from the twofold standpoint of putting off the construction of costly extensions and of shunting away from overcrowded trolleys enough riders to make practicable an increase in the schedule speed, and therefore a decrease in the operating cost, of the electric railway routes.

Where Safety Cars, Trains and Buses Would Make an Ideal System

City No. 3 offered the most interesting case of all. Here was a community of high industrial character and so compactly developed that jitney bus service on the heavy routes can be conducted for 5 cents at a fair profit against 6, 8 and even 10-cent fares on the electric railway. As a consequence, about half the traffic is carried by the jitneymen in buses averaging no more than sixteen seats. Aside from the lower fare, the jitneys appeal to the public because of immensely better headway and somewhat better speed between terminals.

In analyzing this situation with the view of determining whether the 5-cent fare could be restored to the greater portion of the city, the writer was struck by the fact that outlying factories and isolated localities were getting practically none of the service which the motor bus can handle so well. Several attempts to secure direct jitney service had been made by isolated plants, but a guaranteed return plus a premium for punctuality was not sufficient to tempt the jitney operators for any length of time. They were likely to disappear any time that bigger profits were to be had in the heart of the city with its short rides and sardine packing. Of the tens of thousands of workers, only a few hundred were found to be enjoying direct bus service for which they paid some 30 to 50 per cent more than for street car fare—and gladly.

So far as the isolated home area communities were concerned the jitney bus paid no attention to them at all. It is true that police regulations compel them to follow the car tracks, but this rule was made merely to prevent cut-backs and would not apply to a created route over trackless or partially trackless thoroughfares. The remarkable point about the chief isolated area is that it begins within a mile of the center of the city. It is on high ground of most desirable character for residential development. In fact, the trolley lines which flank this area are banked by the best houses in the city. However, because of the hilly country between, each trolley line represents a shoestring development hardly two or three blocks wide. The fare on one of them from city center to a terminus in another township is 8 cents for say 3 miles, while equally good city territory much closer in is almost untouched. The fact that nearly all the highways in this area are well paved in Warrenite asphalt seems to be no inducement to the jitney operator to create a traffic which could not be injured by any car route for years to come!

The solution proposed for City No. 3 contemplates a co-ordinated service that will give ample scope to both car and bus operation. By means of safety car operation it will be possible to cut present headways in half with little increase in operating expenses. This more frequent service will certainly wipe out the jitney operator's margin of profit. It will not pay him to come out only during the rush hours (when he is welcome) because of the heavy overhead which he must now meet in bonding liability, licenses, etc. Deprived of this skimmer of its non-paying rush traffic the railway will have to go to peak-hour train operation, which, of course, will also give higher platform economy. The combination of short-headway safety cars for most of the time and of train operation for part of the time will not only put the jitney out of business automatically, but will also make possible a greater length of ride for 5 cents than is now given for 6 cents. The return to a 5-cent instead of a 6-cent basis would also help to raise the schedule speed and please the public.

However, it is clear from the accompanying map that conditions in City No. 3 do call for a certain amount of bus service. Such service would not pay in itself and therefore would not attract independent operators. On the other hand, if operated by the electric railway in conjunction with the car routes two interesting and valuable results would ensue: First, the isolated areas would be opened up as feeders for the trolleys at an investment which grows only as the amount of business to be handled grows; second, direct routes between factory and home could be installed to shunt via shorter by-paths a lot of people who must now use roundabout trolley routes. These conditions may be referred to more specifically as follows:

Locality "A" is the area close to the business and social center of the city whose growth is hindered by lack of transportation. It is bifurcated by a road which lies between the two trolley lines "1" and "2" and farther on this road branches out most conveniently. In developing a bus service for this section it would not be necessary to run the buses all the way out at once, but simply to keep on extending and extending as the territory was built up. Then in the fullness of time the density of traffic would reach the point where the cost of rail operation would be cheaper. In this particular case conditions favor running the buses directly into the center of the city, especially as the greater part of the run would be by bus.

Localities "B" and "C" may be considered together for a rather unusual reason. Locality "B" is an isolated peninsula which eventually will be all factory, but which is now part factory and part foreign settlement. The overflow from this settlement has, in large part, settled at "C," just outside the city limits. Many of the workers of locality "C" work either in "B" or in locality "D," which is shown on the way from "B" to "C." Unfortunately, the means of travel between all three districts are very poor. People living in "C" who want to find a way to patronize the car line have to walk a mile or so to the terminus of trolley route "3," on which the headways are not particularly good. At that cars of route "3" do not bring them anywhere near "B" or "C." They have to ride downtown to transfer to trolley route "4" and then return in the general direction from which they came. It goes without saying that most of the people prefer to walk in the comparatively straight lines offered by the highways than to take the roundabout rides by trolley. For this public a bus line is needed between "B," "D" and "C," including a connection to trolley route "3" at its terminus.

The purpose of showing three of the streets in peninsula "B" is to disclose the possibility of running the buses on each street in turn until experience has determined which routing will serve the greatest number. The choice of route is not obvious because most of the plants are off on the eastern side. In recommending a bus route to tie "B," "C" and "D" together the writer considered the saying, "Birds of a feather flock together." In other words, areas of like nationality have in common many social and business interests that will produce riding other than that between factory and home. Also in these times when so much is said about Americanization (it should be "humanization") it is a real service in patriotism to draw foreign communities out of their status of isolation. Transportation in this case means more mingling with the rest of the community, better attendance at night schools, theaters, and so forth.

The question of special bus services for factories assumes importance in this city owing to the radial character of the trolley system. North and south cross-town travel is out of the question unless one rides to the most congested part of the city first. Thousands of people who work in locality "D" are obliged to ride into town along one rib before they can ride out of town along another. The irony of this situation is that these riders do not patronize the transfer-less jitneys, but take longer rides on the cars than any one else. If handled by buses many of them would have a ride of but 1 to 2 miles instead of 3 to 4 miles, they would be home within fifteen to twenty minutes instead of thirty to forty-five, and they would have to pay only a very slight additional fare.

In like manner people working in locality "E" but living at "A" would be the gainers by a bus service that would either save them from transferring or would eliminate long walks.

The operator will naturally ask how a special-hour service can be made to pay even if a fare 50 to 100 per cent in excess of 5 cents were to be charged, according to distance. That this service should pay in itself, however, is hardly to be expected, but it can and should be made to pay from the standpoint of traffic relief as a

whole. For example, if this diversion of traffic can speed up the rush-hour car schedules by 1 m.p.h., the company would save daily a substantial sum which should be credited to the account of the bus.

It so happens that the hours of going to work and return from work in this city are spread sufficiently to permit two and possibly three to four loads morning and evening. In addition, the home-luncheon habit encouraged, let us admit, by the short-headway jitney will assure at least two loads in the middle of the day. Another favorable factor is that on several routes there is as much rush-hour traffic in one direction as in the other, owing to the commingling of factories and homes in almost all but the northern or "A" district and vicinity.

Now, to take a leaf from the trick-book of the jitneur, it will be unnecessary to have the buses lie idle when they are not in home-factory service. Many of them can be diverted to the sections serving the isolated communities, aside from specialized livery operation. For example, part of the buses running between "A" and "D" can be shifted during the morning shopping and afternoon hours to the right-hand branch of bus-route "A," which leads into the business and social center. This would merely be doing in a large way what a two or three-route jitneyman does in a small way. As a matter of fact, no concern does this sort of thing better than the great London General Omnibus Company.

The dotted lines on the map on page 849 represent possible trolley links for special rush-hour routes to be built only after the bus has developed a sufficient density of traffic to insure profitable operation.

The foregoing examples by no means exhaust the ways of co-ordinating car and bus operation, but they are adequate to prove that there are possibilities under almost any conditions. In the next article to appear on this subject a discussion of some competitive and some *de luxe* bus services will be presented.

A Massachusetts Company Starts Buses

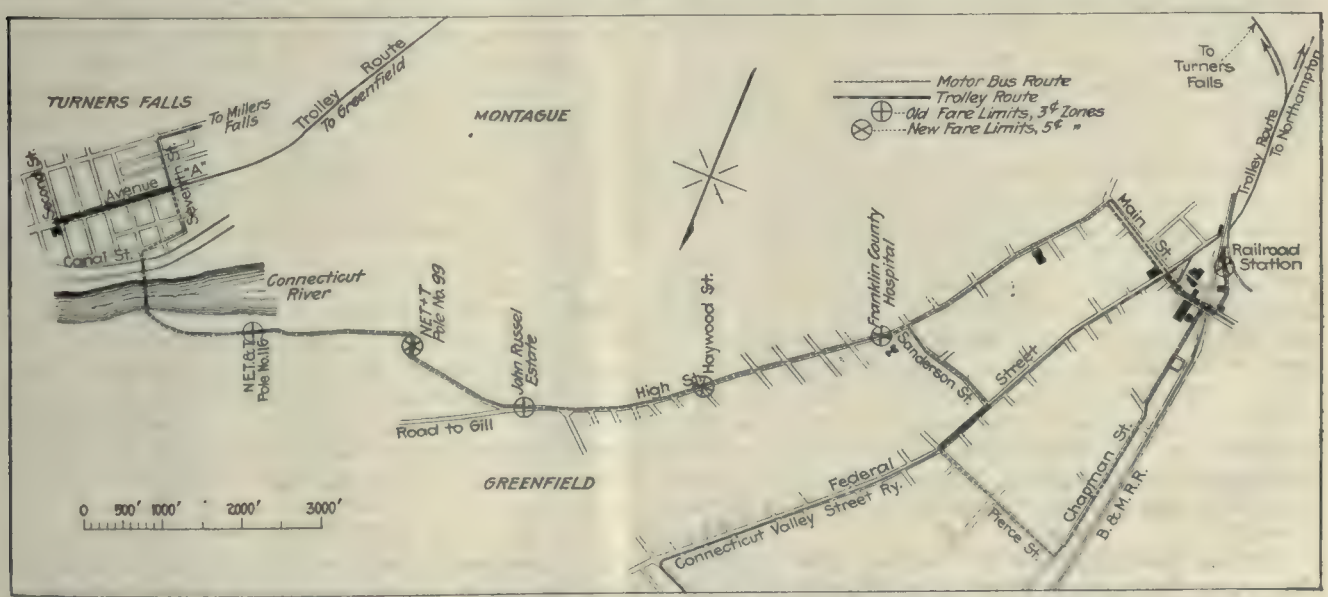
Takes Over Operation of Jitney Route and Substitutes Up-to-Date Buses—Experimental Period Proved Service Justified Higher Fare Than on Trolley

THAT an electric railway company can render high-class motor bus service at a reasonable fare has been demonstrated since Nov. 4, 1919, by the Connecticut Valley Street Railway Company. The public feels assured of the company's good will, for sufficient liability insurance is carried to protect both the passengers and the public.

For the last five years many Massachusetts electric railway companies have had more or less jitney competition, with the result in most cases that what had heretofore been paid out in dividends went into the jitney drivers' pockets. In 1915 independent jitneys began operating between Greenfield and Turners Falls in competition with the Connecticut Valley Street Railway Company. While the two routes did not cover the same intermediate territory, the revenues of the buses were derived very largely at the expense of the railway company, as not enough new traffic was created to offset the railway losses. After the buses had been in operation about two years their revenue was estimated at not less than $25,000 per annum, equivalent to about one-third of the trolley company's gross revenue received prior to competition.

The railway company naturally took various steps to regain the lost traffic, one of which was to cut the running time between Greenfield and Turners Falls from thirty to twenty minutes and to operate cars on a forty-minute headway. This change in schedule, while it slightly increased the revenue, failed to curb the jitney, which seemed to flourish, through lack of any regulations, until seventeen buses of various types were in operation between the two cities.

In 1916 the first of the present regulations under which buses are permitted to operate was enacted. The



PLAN SHOWING MOTOR BUS ROUTE OF CONNECTICUT VALLEY STREET RAILWAY BETWEEN GREENFIELD AND TURNERS FALLS WITH FARE LIMITS UNDER EACH ZONE SYSTEM

State Legislature that year granted all cities and towns of Massachusetts the right to regulate local motor bus service, but required that all buses be operated on a fixed schedule and under a liability bond to protect the patrons. In 1918 additional legislation was enacted, allowing electric street railway companies to own and operate buses, and in the following year all motor bus regulation and operation was made subject to review after April 1, 1920, by the State Department of Public Utilities.

The Connecticut Valley Street Railway had long realized that its round-about trolley route of 4.8 miles could not compete with the shorter 3.14 miles motor bus route and retain the greater bulk of the traffic, nor could the single trolley line properly serve the intermediate territory along the bus route. Rights were therefore obtained under the recent legislation to operate buses over the 3.14 mile route heretofore utilized by the jitneys, as shown on the accompanying map. Service was inaugurated on Nov. 4, 1919, with half-hourly headways between Greenfield railroad station and Turners Falls. The bus route was divided into four zones, each approximately 0.8 miles in length, and the fare was fixed on the mileage basis at 3 cents per zone, with the through rate fixed at 12 cents and the minimum fare at 6 cents for two zones or less. Free transfers were exchanged with the trolleys and vice versa and were accepted either on the buses or trolleys to the limit of the first zone. The fare on the round-about trolley line between the same two points is likewise based on the mileage basis. The through fare is 15 cents.





TYPE OF NINETEEN-SEAT CADILLAC MOTOR BUS USED. AT LEFT, SHOWING HOW BUSES ARE SIGNED. AT RIGHT, SHOWING ONE-MAN ENTRANCE AND EXIT

The company believed from its three months' experimental operation that the superior bus service justified a higher rate of fare than on the trolley cars and on March 15, 1920, the fare was increased to 4.75 cents per mile, with the minimum fare at 10 cents. Transfer arrangements between the buses and the trolleys were entirely eliminated. The Rooke automatic register is used on the buses for making all fare collections.

Under this plan the bus route was divided into three 5-cent fare zones, each zone being slightly more than a mile in length. The 10-cent minimum fare entitled passengers to a continuous two-zone ride and for each additional zone or fraction thereof ridden 5 cents was collected.

For the convenience of the regular rider since the fares were increased on March 15 workingmen's tickets, so called, are sold in lots of twenty-five for $3. These tickets are good during the hours of 5 and 8 in both morning and evening and each ticket entitles the holder to ride from one terminal to the other.

Schedules and Equipment

The first bus leaves Greenfield railroad station at 6:15 a.m. and thereafter on a half-hourly headway until 10:15 p.m. In Greenfield, as will be noticed on the diagram, there are two alternate bus routes. The buses leaving the railroad station at fifteen minutes after each hour follow one route on both inbound and outbound trips, while the buses that are scheduled to leave at forty-five minutes past the hour follow the alternate route, thus giving hourly service in either direction over each route.

The running time between the termini on the bus is less than fifteen minutes as against twenty minutes on the trolleys. Two buses only are required to maintain this schedule, the third being held in reserve for inspection, repairs or emergency. The passenger-carrying capacity of the buses is limited strictly to their seating capacity. The bus operators receive the maximum rate of wages paid the motormen and conductors on the trolley cars.

The automotive equipment to furnish the motor bus service consists of the 1919 model 57-B Cadillac chassis, embodying several changes by the makers to cover the heavier service requirements, namely, the chassis was lengthened 10 in. to permit mounting a 14-ft. body, having an outside width of 7 ft.; larger springs were substituted and the gear ratio was modified to reduce the maximum speed. Larger and heavier pneumatic tires are used throughout, 35 in. x 5 in. being used on the front wheels and 37 in. x 7 in. on the rear wheels. All bus bodies were built by the Unit Manufacturing Company of Amesbury, Mass., and have the entrance and exit through a front right-hand door which is interlocked with the step and manually controlled by the bus operator. An emergency rear door can also be operated in a similar way. Heywood Brothers & Wakefield cross rattan seats are provided for the nineteen passengers. The buses are also electrically lighted, have push button signals to the operator, drop windows and heavy rubber mats on the floor.

Cost of Operation

Two buses were placed in service on Nov. 4, 1919, and for a period of ninety-four days earned $5,458.66, or an average of $29.01 per day per bus. The mileage

INCOME STATEMENT

	Total	Per Bus-Mile (Cents)
Operating revenues	$5,458.66	21.56
Operating expenses:		
Wages of bus operators and repairmen	2,162.00	8.53
Gasoline—3,625 gal. at 26 cents	942.50	3.72
Oil—188 qts. at 20 cents	37.60	0.16
Tire allowance	761.40	3.00
Insurance	282.00	1.13
Depreciation	2,030.40	8.00
Total operating expenses	$6,215.90	24.54
Deficit from operation	$757.24	2.98
Taxes	100.00	0.40
Interest	225.00	0.89
Net loss from bus operation	$1,082.24	4.27
Saving on trolley car operation, 140 miles per day at $35 per day	3,290.00	*25.00
Net revenue from operating buses	2,207.76	8.72
Bus-miles operated	25,385	.....
Average miles per gallon of gasoline	7.0	.....
Miles per quart of oil	135.0	.....

* Per car-mile (trolley).

operated was 25,385, equivalent to 135 miles per bus per day. The earnings per bus-mile thus average 21.56 cents.

The cost of operation of the service rendered for the same period, which covers not only the wages of repairmen and operators, gas, oil, etc., but overhead expenses, including really a larger depreciation reserve than necessary, indicates that the buses were run at 25.73 cents per bus-mile. In these costs depreciation is figured at 8 cents per bus-mile, which would extinguish their initial cost of $4,800 at approximately 60,000 miles. It is fair to say that this rate of depreciation is high and does not consider the scrap value of the bus, nor does it take into account the fact that the automotive power plant depreciates faster than the rest of the equipment.

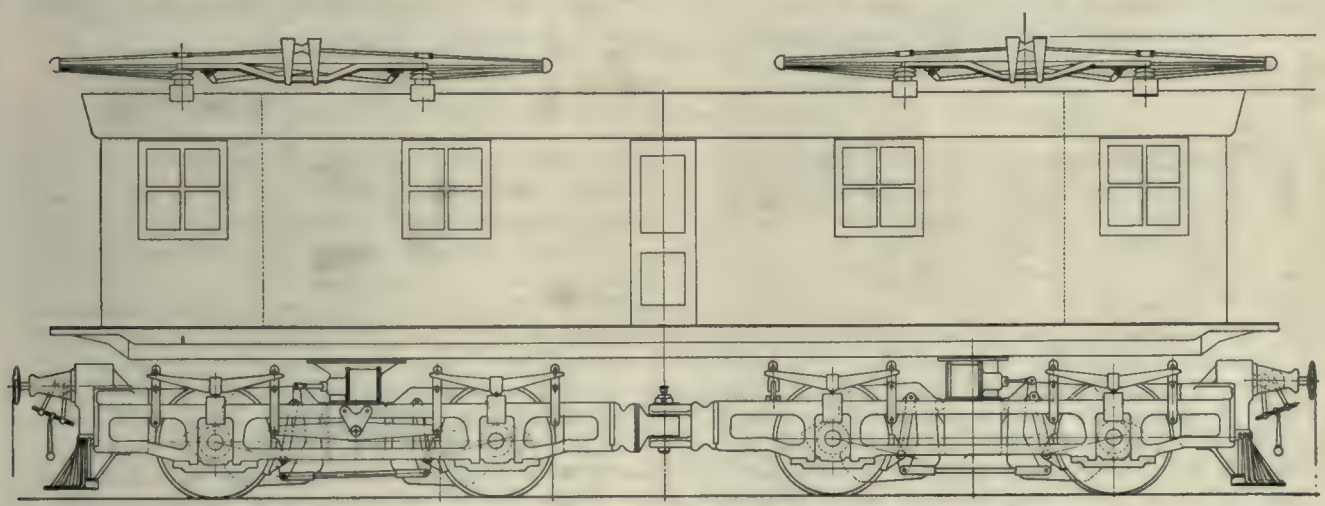
Another factor to be considered by the company is the net cost of operation of the property as a whole, for as the result of the bus operation there was a saving of 140 trolley car-miles per day between Greenfield and Turners Falls. If only the actual cash expenditures of $35 per day to provide this car mileage is considered, added to the net income from the bus operation, the result would be then a fair surplus instead of a deficit, as would be the case if the bus operation was considered as standing alone. Then too, the daily bus earnings show an upward tendency, and it must also be remembered that for a part of the period of operation heavy snows materially increased operating costs. The accompanying income statement shows the results in total and per bus-mile operated for ninety-four days' operation commencing Nov. 4, 1919.

Paulista Railway Electrification

Line in Brazil Having 28 Route Miles Will Be Equipped for Operation at 3,000 Volts, Direct Current

THE double-track line of the Paulista (Brazil) Railway, between Jundiahy and Campinas, will be electrified at once, on the 3000-volt, direct-current system. The route mileage is 28, the total length of single track involved being 76 miles. A later 100-mile extension from Jundiahy to San Carlos is contemplated.

The locomotives will be of the geared type and these and the overhead construction will be designed after the models furnished by the Butte, Anaconda & Pacific and Chicago, Milwaukee & St. Paul Railways. The locomotives will be similar to those used on the former, as will be seen from the accompanying illustration, but they will be furnished with regenerative braking control. There will be eight freight locomotives weighing 100-tons each, with all weight on the drivers, and four 120-ton passenger machines with two guiding axles at each end.



SIDE ELEVATION OF 100-TON ELECTRIC FREIGHT LOCOMOTIVE FOR BRAZIL

The locomotives, overhead contact and transmission line material and substation equipment will be furnished by the General Electric Company. Power for operation will be furnished at 88,000 volts, 60 cycles by the Sao Paulo Light & Power Company.

Accident Fatalities in Cleveland

IN commending the work of the local Safety Council, Dr. H. L. Lockwood, Health Commissioner of Cleveland, Ohio, has given to the council the following data (see *National Safety News*, March 22):

ACCIDENTAL FATALITIES OCCURRING IN CLEVELAND DURING 1918 AND 1919

	Jan. 1 to June 30, 1918	Jan. 1 to June 30, 1919	July 1 to Dec. 31, 1918	July 1 to Dec. 31, 1919
Railroads	30	22	29	27
Street cars	16	9	22	23
Automobiles	46	63	143	73
Other vehicles	7	4	8	10
Other causes	18	11	27	12
Total	117	109	229	145



CLEVELAND'S PUBLIC SQUARE, UNDER WHICH COMMISSION PROPOSES THE LOCATION OF LOOP SUBWAY STATIONS

Rapid Transit for Cleveland

April 27 People Will Vote on Plan for Relieving Street Congestion, Involving Subway with Loop Stations Under the Public Square

BY HENRY M. BRINCKERHOFF
Of Parsons, Klapp, Brinckerhoff & Douglas, Consulting Engineers, New York City

THE PLANS of the Rapid Transit Commission of Cleveland for a group of short terminal subways for street cars, leading to loop stations under the Public Square, are now before the people of that city for consideration and will be voted upon at the election April 27. These plans* call for a bond issue by the city of $15,000,000, most of the interest on which is to be spread upon the general tax levy. The Cleveland Railway is to operate the car service in the subways under an agreement with the city, which is essentially the Tayler plan, enlarged to cover this new service. The company will pay the interest on the tracks and electrical and other equipment in the subway, while the city will own the structures themselves, pay the interest thereon and control the train and car service under the Tayler plan of regulation.

An interesting question arises in this connection as to the principle underlying the construction of short sections of subways in the center of the city as a "first step toward rapid transit," as is stated in the commission's announcements. In the following the writer presents a brief statement of the basis of the plan and the warrant for the phrase just quoted:

DUPLICATION OF TRANSIT FACILITIES IS COSTLY

Cleveland has just reached the point where its metropolitan district houses 1,000,000 people. Cities which have passed this mark, such as Philadelphia, Chicago, Boston and Brooklyn, commenced the development of rapid transit systems when they were at or near 1,000,000 in population. The general public demand for a rapid transit service is therefore normal as viewed from the standpoint of experience and the development of cities which in population and area have grown to perhaps twice the size of Cleveland today.

In studying the larger cities from whose traction history and present condition certain valuable lessons can be learned, we must remember that their surface and rapid transit lines were built under private initiative and on a competitive basis. Much of the trouble lying at the bottom of the present public complaints of inadequate service is due to the practical financial difficulties of earning fixed charges upon the investment in duplicated and competing lines. This, coupled with a natural public demand for a low rate of fare, exaggerates the effect of the economic waste of two competing systems as against one unified consolidated set of transportation lines.

From the viewpoint of the car riders the ideal system in a large city would be one giving the freest possible use of all lines, surface and rapid transit, by universal transfer of passengers and the arrangement and co-ordination of each class of service completely to cover and serve the constantly broadening city area.

An effort to produce such a co-ordinated system in the larger cities today develops at once the fact that there is a considerable duplication both of physical structures and investment, as the tracks and equipment are in places in duplicate and often parallel, due to their competitive origin. If these tracks and systems could be completely wiped out and a carefully planned, unified system substituted the rapid transit trunk lines could be used for the congested and long-haul business and the surface cars run as feeders to these trunks to accommodate the strictly short-haul traffic. Thus, much better accommodations could be afforded the public at less original cost and at a lower operating expense.

Given a city like Cleveland, therefore, without any rapid transit development, and looking to a future city of perhaps twice its present size, it is reasonable to propose so to plan the initial steps of the rapid transit lines as to avoid the obvious shortcomings seen in the

*See issue of ELECTRIC RAILWAY JOURNAL for July 12, 1919, page 71.

dual competitive systems found in our larger cities. The fact that Cleveland has controlled its street car service for the past ten years under the direction of a city commissioner makes easy the task of dealing with the practical operating questions of such a combined service.

With the present high cost of materials and labor in all construction and with the proposal to expend public money upon permanent structures without thought of profit the obligation lies heavily upon the engineer to plan the system so as to make each dollar build the maximum of facilities and the design provide for the greatest economy in running costs.

Some Details of the Commission's Plans

The plan proposed by the Cleveland commission attacks the problem by first bringing the surface car lines to their maximum capacity and usefulness.

The principal difficulty with the existing Cleveland surface car lines lies in the congested condition of all traffic in the central business district. Forty-five per cent of the passengers riding on the street car lines entering this district ride to or through the Public Square or its immediate vicinity. The greatest volume of long-haul traffic in the city is east and west, parallel with the lake shore, and passes through the Public Square.

The principal surface car lines entering this central district will under the proposed plan be run down into the subways before reaching the congested area. The result will be that with the wide streets comparatively unobstructed in the outlying sections and with the cars in the subway in the congested districts a very much more regular and higher speed service will be rendered than at present.

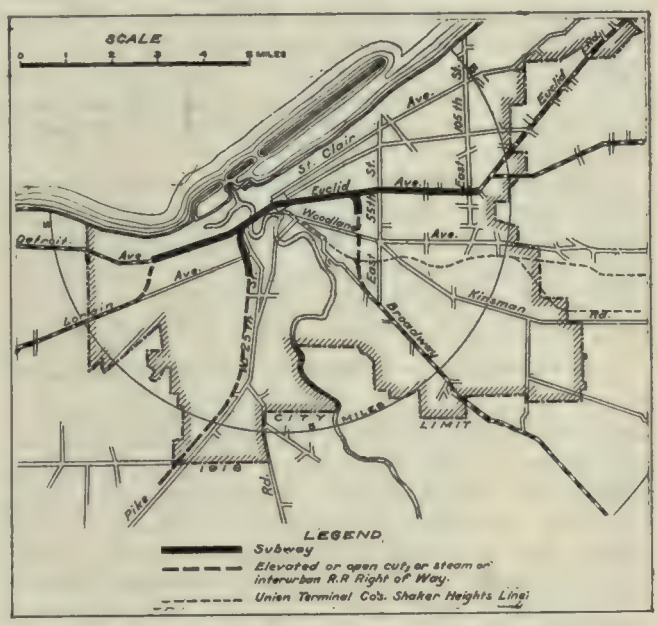
The elimination of congestion in the Public Square district during rush hours will not only save a certain amount of time for the rider, but make it possible to load fully for the outlying tracks, which now have greater capacity for car movement than can be passed through and loaded in the Public Square and congested delivery district. This will therefore result in making it possible to run many additional cars, with consequent greater comfort to the public and greater earning capacity for the system.

The arrangement of the subway tracks in the Public Square is such that the radiating street car lines can be operated independently from this point in various directions or can be connected up and run through across the city. The loading platforms, switches, loops, etc., are so designed in this central subway transfer station as to permit through routing of a part of any of the surface lines and the turning back of the unbalanced portion. In this way the usual practical objection of through routing is avoided, as no idle car mileage need be run, but the through cars can be proportioned to the actual demand for through service and the heavier end of the line fully supplied with cars without running useless mileage on the lighter side of the city. It will be admitted that this should produce a street car system operating under the most favorable conditions for the rendering of regular, uninterrupted and high-speed service to the traveling public.

The question of rapid transit is answered by designing the sections of the subway, the loading platforms, curves, loops and all clearances so that trains of standard rapid transit cars can be run through these subways. The development of separate rapid transit train service on any one of these lines can then be accomplished by extending any one of the five radiating subway sections far enough to warrant such service.

It is contemplated that it may be possible to connect the present short subway sections to elevated lines or to lines on private rights of way or even to use some of the steam railway lines to reach the outlying districts. The present subway construction is therefore literally a *first step in rapid transit.*

If one of the present short sections is extended, as for instance the Euclid Avenue section, for several miles train service can be placed in this subway and a limited number of street cars continued to be operated upon the street car tracks directly above. As this plan contemplates a unified system, operated by the same company and under city control, transfers can be given from the rapid transit line to the street cars by vertical transfer at station points. The subway trains will then perform



OUTLINE MAP SHOWING PROPOSED RAPID TRANSIT DEVELOPMENT FOR CLEVELAND

the function of express service and the street cars on the surface tracks above will operate as local service, making frequent street corner stops. The subway trains will stop only at stations spaced at about one-third-mile intervals. In the building of further street car lines or in the rerouting of the existing lines further development of this idea can be obtained by running cars directly to certain stations on the extended subways where transfers can be given to the trunk or rapid transit subway trains.

Thus it is planned to develop a system which will produce a thoroughly co-ordinated development of surface and rapid transit lines.

Commission Estimates a Rapid Transit Investment Cost of But $75 Per Capita

It is interesting to note in this connection that cities such as Chicago, Boston, Brooklyn and Philadelphia have from $95 to $110 per capita invested in their combined surface and rapid transit lines. A study of a plan for a city such as Greater Cleveland when it shall have grown to a population of 2,000,000 indicates the possibility of developing a satisfactory trunk line rapid transit system giving transfers to a surface system with

radiating or crosstown street car lines at from $70 to $75 per capita.

The economic value of locating and building the rapid transit lines so as to utilize effectively the street car lines to their maximum capacity as feeders and for local hauls is obvious. This will avoid the evil of competing lines and effect a great saving in investment, while at the same time keeping the whole system under one management and city control.

The objection made by those familiar with the transportation system of Boston that a similar plan in that city resulted in high rates of fare and excessive investment per capita misses the very essence of the proposed Cleveland rapid transit plan. The Boston system started with street car subways in the downtown district, but the subsequent development has been allowed to run into the excessive building of expensive rapid transit subways and tunnels. The high cost is partly due to the separation of the various parts of metropolitan Boston by waterways requiring long subaqueous tunnels. Narrow and crooked streets have made difficult the full development of surface car lines. In Boston also the interest charges are all carried by the car riders.

In Cleveland, with its wide streets and with only its single river and valley separating its principal metropolitan area, no excuse arises for such great expenditures in subway and tunnel construction. The commission's plans also provide for relieving the car rider by spreading the fixed charges largely on the tax roll.

"The First Step in Rapid Transit" for Cleveland

The Rapid Transit Commission's plan in Cleveland will in this first step create a hub with radiating spokes, any one of which can be developed by extension into the outlying districts of the city. The extension of any one line must depend upon the traffic development in the district such as to warrant the extended building of the permanent rapid transit structures and the operation of trains.

"The First Step in Rapid Transit" is therefore a justified expression as the development of this system is planned. It is proposed to attack first the most vital difficulty confronting the city, namely, that of congestion and delays to the existing service. Outlying rapid transit lines not traversing this downtown district and leaving the street car lines choked and throttled by vehicle traffic would not be a justifiable first step. More of Cleveland's own citizens will be benefited by the present proposed first step than by the expenditure of an equal amount of money in a single competing rapid transit line in any one of the various radiating directions followed by its main thoroughfares.

A. L. A. to Help Industries

The American Library Association, which during the war supplied the men here and overseas with more than 7,000,000 books, is undertaking an enlarged program through which it hopes to create a far wider reading interest throughout the nation. Through librarians, library trustees and friends of libraries it is now creating a fund of $2,000,000 to aid in a general campaign for Americanization. In this direction the association will encourage the establishment of technical libraries in plants and factories, will further the county library system, etc.

Rezoning Effective on May 9

Connecticut Company to Appeal from Commission's Decision on Reduced Rates for Zone and Commutation Tickets

PRESIDENT LUCIUS S. STORRS of the Connecticut Company on April 21 issued a statement that the company would appeal to the Superior Court of Hartford County from the recent decision on the zone system of the Connecticut Public Utilities Commission, in so far as that decision affects its "fundamental rights," the specific complaint being that in allowing commutation tickets the commission virtually confiscates the property of the company. The appeal, however, will have no effect on the new rates ordered in effect for May 9 by the commission. The company is hard at work rezoning its system on the mile-zone basis.

The statement sets forth that it is the belief of the company that the commission exceeded its powers in suggesting the installation of reduced rate tickets. It also contains a warning that it may be necessary to increase fares further or eliminate service on some lines altogether in case the proposed rates do not produce sufficient revenue. Reduction of revenue can be prevented only by a greater use of the service.

Mr. Storrs' statement follows:

Company Will Appeal

The directors of the Connecticut Company have made a careful study of the finding and order of the Public Utilities Commission regarding the system of fare collection and rates installed by this company in November 1919.

In adopting this system our primary object was to preserve to the communities served the extensive fabric of street railway facilities which had been developed during a period of many years and upon which the social, business and industrial life of so large a portion of the state depends.

We regret that the commission did not see its way clear to permit a longer trial of the system which we had adopted after such careful consideration and comprehensive survey of the riding characteristics on all lines, but it is our intention to place the new schedules in effect as proposed, using our best endeavors to make the plan a thorough success.

It is gratifying that the commission so fully approves the method of collecting fares based upon the distance traveled and we appreciate that the commission has been most desirous of affording a just and proper solution of the many difficulties inherent in the situation. Both the commission and the company are endeavoring to obtain the same results, but, as is pointed out in the finding, full co-operation of the public is necessary to enable the company to maintain adequate service. It is, of course, essential that our revenues are not reduced and this can only be accomplished by a greater use of the service under the proposed rates of fare. We think that the theory upon which all street railway fares should be based—that of giving the maximum of safe and convenient service at a minimum charge—does not justify the making of any reduction from established cash rates for any class of riders.

It is to be hoped that such use will be made of the service under the proposed rates as will produce sufficient revenue in order that it may not be necessary further to increase the rates or materially reduce the service which on some lines would result in the entire elimination of the street cars.

There is a legal question involved and we are advised by our counsel that it is probable the commission has exceeded its powers in suggesting the sale of tickets at reduced rates and the installation of commutation tickets. In view of this fact the company has felt constrained to file an appeal with the Superior Court, but with the definite desire of not contesting any further than is necessary to preserve our fundamental rights at this time.

Until the rezoning, which is now in progress, is completed no estimates can be made as to the effect of the proposed rates upon any particular fares.

An interview with the commission prior to the time the company decided to appeal the case brought out

that it was its intention to increase the income as a whole and to establish lower rates for the regular rider. It believed that the casual patrons, including those that rode only when other forms of competitive transportation were not available, should pay a higher rate and for that reason made the cash rate per zone 3 cents. With the new zone rates established and good merchandising methods on the part of the company, the commission said that it hoped that a larger income would be derived from the passenger business without discriminating wholly against the suburban rider. The increase in revenue under the plan should keep pace with the increased cost of rendering service. To reduce expenses and taxes, the commission urges that the company be relieved of paving charges, bridge assessments and other forms of indirect taxation that it is now required to pay at the expense of the car rider.

In pushing out the minimum fare limit a half mile from the traffic centers the commission also hoped to decrease the travel on jitneys, providing the company rendered adequate short-line service out to this fare limit.

The commission believes in up-to-date merchandising methods in the way of advertising in the cars, to bring to the attention of the car rider the unnecessary burdens that are now imposed upon him because he rides upon the cars, and what these burdens mean not only to the local company but to the street railway industry as a whole.

Commutation and zone tickets were established because the evidence at the hearings showed that the existing zone fares were discriminatory against the suburban rider. The commission also held that the use of such tickets would speed up the fare collection on the cars as it would eliminate a large percentage of the change making at the unloading points. The principle of pay-leave as the best system of fare collection under a distance tariff was indorsed.

The commission retains jurisdiction over the zone system established, not only as to the location of the zone limits but as to the rates themselves, and should it prove after a fair trial that the system does not earn sufficient revenue to pay a reasonable return, the ticket rates will be increased gradually until they reach the cash fare rate of 3 cents per zone.

What Some Newspaper Men Think

When the finding was discussed with several daily newspaper men, one stated that he believed that the decision would simply reduce the trolley income without lessening expenses and that the cost of operation would very likely be increased because the trainmen might ask for additional wages due to claims of extra work. While it is true that the commission urges a reduction in taxes, both direct and indirect, and the elimination of unfair competition, this cannot be accomplished until the next legislative session, which does not meet until 1921.

The commuter, he said, is the only one who can rejoice over the finding, for he is favored with a lower rate. For a little more than half the amount of fare the casual must pay, the commuter can make his daily journeys. The city rider who buys the new zone tickets will ride for two-thirds of what the casual rider will pay. The unearned increment of the suburban land owner is safeguarded, and the rural dweller's property values are increased at the expense of the trolley company, which is made a public benefactor without a chance of getting any reward.

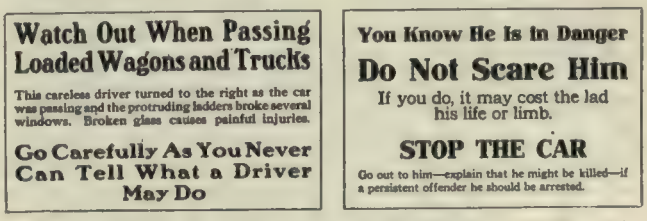
Having established new rates, the commission assumes responsibility for the financial future of the company. If they result in further deficits the fault will rest with the commission, for the company under its own plan has been receiving a material increase over that earned with the 6-cent fare. Any criticism of the Legislature for failure to grant the relief suggested will under these circumstances avail nothing. The commission should consider conditions, not possibilities, and if the conditions it is creating are to make the trolley situation worse than it now is, instead of better, its obvious desire to placate complainants must bring a reaction.

Bridgeport is particularly displeased with the result, for an element there sought to have the lines in that city segregated and operated under a nickel fare with safety cars. While the commission has properly denied the segregation claim, nevertheless the city is greatly agitated over the high cash fare and the discrimination in favor of the rural dweller. One editor says, "the more one studies the zone fare order the more ridiculous, impractical and harmful it appears. It is full of high-sounding phrases such as 'inequalities of fares,' which it promises to adjust, yet the actual effect of its adjustment is to make them more unequal than ever."

At the hearings several cities and towns indorsed the company's plan and believed that it entirely safeguarded the public welfare, but now Waterbury and New Haven show no great pleasure over the finding.

Careless Drivers and Reckless Boys

THE accompanying illustrations are reproductions from current bulletins issued by the National Safety Council. The one at the left is accompanied by an appropriate illustration of the accident described, a hazard to passengers and rolling stock that is growing more serious each day. A circular letter accompanying the bulletin directs attention to the fact that while the motorman cannot always foresee possible accidents, such a bulletin as this will serve as a reminder to him



THE TEXT OF TWO RECENT BULLETINS ISSUED BY THE NATIONAL SAFETY COUNCIL

to be constantly on the lookout for this specific hazard. In such accidents the burden of responsibility is placed first on the motorman, notwithstanding the fact that investigations usually show that the driver of the wagon or truck was at fault.

The bulletin at the right is accompanied by an illustration showing a small boy "flipping" a car. An accompanying letter states that conductors should be instructed to handle the boy problem tactfully and especially to avoid frightening boys, for it is while frightened that they are most likely to be injured or killed. It may be advisable to station supervisors at certain points where boys are especially troublesome.

American Association News

THE ANNUAL CONVENTION OF THE A. E. R. A. WILL BE HELD IN ATLANTIC CITY, OCTOBER 11 TO 15. WAY COMMITTEE HOLDS TWO-DAY SESSION. MERCHANDISING TRANSPORTATION DISCUSSED AT COMMITTEE MEETING IN NEW YORK

Convention at Atlantic City, Oct. 11 to 15

THE thirty-ninth annual convention of the American and affiliated associations will be held at Atlantic City, N. J., from Oct. 11 to 15, inclusive. Announcement of this decision has just been made, following a meeting of the committee on location held at Atlantic City on March 24 and after the committee had con sidered a number of other locations.

A committee on exhibits and other convention committees will soon be appointed to begin active preparations for what is expected to be the largest and most successful annual convention ever held by the association.

Work on the program of the American Association meeting is already under way and the programs for the affiliated associations have been practically completed. From the interest already shown by the manufacturer members this year's exhibit of apparatus and devices promises to surpass anything held in previous years.

Contracts have been entered into with the management of Young's Million-Dollar Pier, where the convention and exhibit will be held; with the Atlantic City Hotel Men's Association, with C. M. Koury & Company, for furniture, rugs and furnishing; with J. J. Habermehl's Sons, for floral decorations, and with the Eldredge Express Company, for hauling exhibitors' materials.

The members of the committee on location are George Keegan, chairman; Martin Schreiber, John M. High, W. R. Hulbert, Thomas Casey and E. B. Burritt, secretary.

Two-Day Session of Way Committee

THE committee on way matters met at association headquarters in New York on April 15 and 16. Those members in attendance were: R. C. Cram, Brooklyn, chairman; A. E. Harvey, Kansas City, Mo.; H. A. Abell, Rochester, N. Y.; C. A. Alden, Steelton, Pa.; Victor Angerer, Easton, Pa.; E. B. Entwisle, Johnstown, Pa.; E. M. T. Ryder, New York City, and H. Fort Flowers, New York City.

On the subject of standard specifications for track spirals, a system of spirals as prepared by the subcommittee was recommended for adoption as "recommended practice" and plans were made for an early subcommittee meeting to work out suggestions of application of the system of spirals suggested. It was stated that for use in consideration of the subject of standard sections for curved rail heads a questionnaire was sent out to the member companies, but up to the time of the meeting only five replies had been received. Three of these indicated no use for the rail in question, while the two others indicated satisfaction with this design. One of the latter submitted blueprints of standard rails in use and worn wheels and rails. Those showing rail wear indicated close agreement with the general outline of the curved-head rail shown in the Lorain Steel Company drawing No. 122-491. It was decided that the committee should recommend a change in the association's recommended design for 7-in. and 9-in. grooved girder rails to eliminate the flat or plane head and substitute a curved head to agree with the Lorain Steel Company's drawing mentioned above. The equipment committee, represented at the discussion of this subject by F. W. Sargent, concurred in this recommendation. It was also decided not to recommend a change in the designs now recommended for girder guard rail. This latter subject is held open for final decision.

In the discussion of the assigned subject of progress in rail joints the committee raised the question as to whether the arc-welded joint is good practice and what happens when it is applied. It was decided to consult the Bureau of Standards to determine what arrangements can be made for a thorough investigation of joints, including all types of welded joints. The subject of revised specifications for plain bolted special trackwork was discussed, and it was decided that Section Ws 8a of the Manual needs complete revision. It was suggested that there should be incorporated in this section a paragraph on plain bolted crossings and something additional on insert work.

The subject of specifications for wood-block paving was discussed at some length. One member of the committee expressed the opinion that a granite flangeway should be retained inside the rail whenever wood block is used as a pavement. It was agreed that the use of wood block should be limited to new construction and to absolutely first-class track. It was brought out that in answer to a questionnaire sent out by another association 51 per cent of the electric railways answering said that with modern, properly constructed track wood block can be used with satisfaction, 23 per cent said they had no use for it and 26 per cent failed to answer the question. The committee will review this subject as reported by the American Wood Preservers' Association.

In the discussion of the subject of revision of the Manual, it was decided that some form of concrete slab construction substantially like type C, formerly suggested, should be recommended for use under special conditions. This is a revision of section Wf 1a. Some plans for new designs of track construction are to be formulated and the use of steel ties is to be reviewed and some recommendations suggested. In section Wm 1a it was decided to change the phrase "special work" to read "special trackwork," using trackwork as one word. It was also decided to change the definition of special work to read "switches, mates, frogs, crossings, guarded curves and parts of track other than plain straight track and plain unguarded curves."

On section Wm 3a there was considerable diacussion in regard to the elimination of the word "T-rail" from the specification for splice bars for girder and high T-rails. The change recommended is for reasons of policy and not on account of engineering considerations,

and is due to the aversion of city engineers to the use of T-rail. The recommendation adopted was that the recommended specifications should read "Specifications for splice bars for girder rails of plain, grooved and guard types." In a discussion of section Wm 7a it was brought out that from tests made by the American Railway Engineering Association it had been determined that six-hole drilling of rail joints was not necessary and did not add any strength to the joint. It was decided to eliminate the drawing showing the six-hole drilling and to show instead the four-hole drilling.

It was recommended that the recommended design for plain girder rails for use in paved streets shown in section Wr 1b be brought to the attention of the ensuing committee with the suggestion that these designs be changed to conform to general usage. The suggestion is based on the belief that the 80-lb. rail has never been used, that the 90-lb. rail has never been rolled and that the 100-lb. rail has had practically no use by either steam or electric railways. A report will be made on this subject at the next meeting of the committee.

At a discussion of the recommended specifications for the manufacture of open-hearth girder and high T-rails, section Wr 2c, it was recommended that the title be revised to read "Specification for the manufacture of open-hearth steel girder rails of plain, grooved and guard rail types for use in paved streets." Under this section the matter of the modified Brinell or impression test was thoroughly discussed. The consensus of opinion seemed to be not to abolish the drop test until more was known of the Brinell test, in spite of the fact that the American Society for Testing Materials has specifically adopted the latter tentatively until 1921. The matter was referred to a sub-committee for a report on the merits of the proposition and recommendations as to what it is believed the committee should recommend in its report.

On the subject of safe limit of wear on rails, it was stated that some data have been obtained and that additional data will be prepared on this subject. On the subject of safe limit of wear on special trackwork, it was suggested that the safe limit and the economic limit coincide for all practical purposes and that the economic limit of wear depends on many conditions such as the effect on rolling stock, on surrounding pavement, on the nerves of trainmen, passengers and surrounding inhabitants, etc. It was decided to send out a questionnaire to assist in the compilation of data on this subject.

It is expected that another meeting of the committee will be held some time during June.

City Engineer Praises Connecticut Company

THE thirty-fourth monthly meeting of the Connecticut Company, section No. 7, was held at the Hotel Garde, New Haven, on April 8. Sixty members and guests attended a seven o'clock dinner preceding the addresses.

President W. R. Dunham, Jr., first presented Robert A. Cairns, city engineer of Waterbury, Conn., who referred to the pleasant business relations between his office and the Connecticut Company. He made special reference to the service which the Connecticut Company performed during the storm period of February and March, not only in providing service but in clearing the streets for other vehicles. On account of his using an automobile for his own transportation, he had judged service only by hearsay until a memorable trip from New Haven to Waterbury showed him a sort of service satisfactory in every way, which indicated that some one must have planned the operation with a view to making it satisfactory. He commenced to believe that railway officials are really working efficiently on the job, and not loafing.

The other speaker of the evening was A. R. Williams of Providence, R. I., attorney for the Rhode Island Company. Mr. Williams took as his text "Leninetrotzkyitis, the bug; where it came from and where it is going," and analyzed from the historical viewpoint the present social unrest. His talk was full of sound encouragement for sane American thought and action in the present crisis.

Merchandising Transportation

ON APRIL 12 a preliminary meeting of the committee on merchandising transportation was held at the association headquarters in New York. Due to the railroad strike, the only members of the committee who could attend were F. G. Buffe, Kansas City, Mo., chairman, and W. H. Boyce, New Brighton, Pa. It was thought best, in order to get the work started, to attempt an analysis of the subject and to assign to members of the committee different divisions of the subject upon which to prepare a report for a meeting to be held some time during the latter part of May.

The subject of merchandising transportation was subdivided as follows:

1. Scope of the subject; report to be confined strictly to merchandising methods and not to enter the field of public relations or to include much general matter.

2. Bibliography of the subject and brief synopsis of work along similar lines by previous committees.

3. Direct methods of merchandising transportation: (a) Advertising—Billboards, "movies," newspapers, letters, publications. (b) Service—Extent to which proper service adds to the salability of transportation. This will include headways, proper schedule regulations, use of loading platforms, rearrangement of congested district stops, etc. (c) Employees—Means of educating employees along the line of salesmanship. Necessity of securing co-operation of transportation service employees and means to arouse their interest. (d) Ticket fares—Method of selling, agencies, selling by mail, etc. (e) Merchandising of transportation, with particular reference to meeting jitney competition. (f) Merchandising of transportation, with particular reference to the operation of safety cars.

4. Indirect methods of merchandising transportation: (a) Co-operation of public bodies—This subject will deal with the opportunities of awakening Chambers of Commerce, Public Service Commissions, etc., to the necessity of helping to increase the business.

5. Recommendations.

The thought expressed by the committee was that urban transportation today, due to jitneys and the rapidly increasing use of private automobiles for business purposes, is more than ever a competitive business. It is subject to the law of supply and demand and will respond to advertising. It is dependent upon salesmanship methods, and within certain limits will react to the stimulus of merchandising methods. The subject is to be considered only from this point. While merchandising is dependent upon public relations, which in the

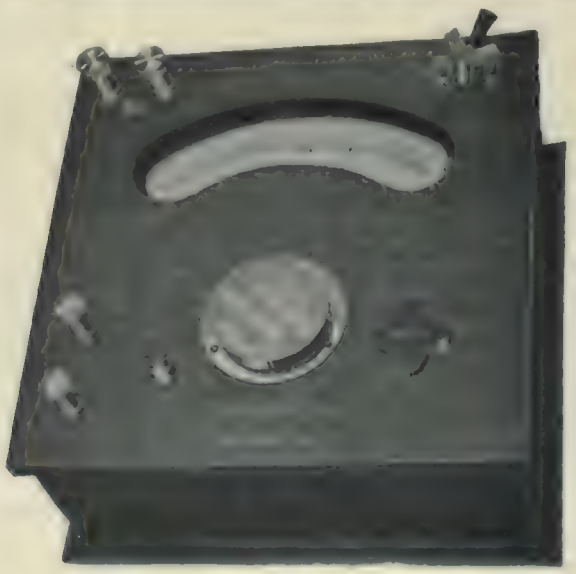
last analysis constitute "good will," the report of the committee will not attempt to go into this side of the question, but will confine itself to the means and methods whereby the service to be sold can be made more attractive; to the education of employees so that they may represent their company more in the capacity of salesmen than heretofore; to the mediums of advertising, and the appeal that will most quickly attract business; to the help that it is possible to obtain from public and civic bodies, and to the advantages offered by the widespread use of tickets.

Electric Railway Address at Chamber of Commerce Meeting

THE program for the general session on Wednesday morning of the United States Chamber of Commerce convention next week has been changed to admit of an address on electric railways. The speaker will be John H. Pardee, president American Electric Railway Association, and the subject will be electric railways in relation to increased production. The session on Wednesday morning will be devoted entirely to the subject of transportation in relation to increased production, and the address on electric railways will be preceded by others on steam railroads and followed by others on highways and the merchant marine.

New Type of Indicating Ohmmeter

THE Thompson-Levering Company, Philadelphia, is marketing a new type of indicating instrument called the Vawter Ohmmeter. This is an aperiodic or dead-beat instrument and does not require any preliminary adjustment calibration. Some eight different types



INDICATING OHMMETER

of the instrument are being manufactured in order to meet every requirement of resistance measurements from microhms up to megohms and for any degree of accuracy to one involving an error as small as 0.1 of 1 per cent. One application of this instrument is to measure the resistance of a section of electric rail containing a bond in terms of 1 ft. of the solid rail that is bonded. Another low-resistance type of this instrument, used in conjunction with ordinary current-carrying shunts, indicates the resistance of transformer, armature or field coils of low resistance.

Insull Speaks at W. S. E. Luncheon

Points to Duty of Engineers to Know the Facts and Pass Knowledge Along to Public

AS THE speaker of the day before the first regular monthly luncheon of the Western Society of Engineers, Chicago, Samuel Insull talked about the influence of engineers in connection with the public utility industries. He said that they should be the leaders of thought in utility problems; that they should make it their duty to post themselves on the facts and apply their powers of reasoning and exact statement to the work of enlightening the public in utility matters, and in public questions in general involving engineering thought. He criticised the engineers as a group for their tendency to react against new, broad utility developments and to point to the difficulties rather than to post themselves and advocate the great possibilities.

Speaking of the incessant talk about "home rule" of public utilities, Mr. Insull remarked that the whole tendency of public utility control is irresistibly more than an urban problem and that it could only be settled on a state or interstate basis. This was one example of where the engineer might exert his influence advantageously. Another situation in which the engineers could help toward sound progress was in connection with the broad assertions which are made about the water-power resources of the country. He stated that if all the water powers of the United States could be used the total energy thus made available would not be sufficient to take care of more than half of the present demand for electrical energy. He said also that the possibilities for using oil or gas for fuel in any extensive way was out of the question. This pointed to the fact that the future wealth and well being of the country depend on the coal supply, thus emphasizing the imperative need for securing the utmost economy in coal consumption through interconnection of power systems, electrification of railroads, etc. He declared that the known supply of coal in the United States was great enough, if proper economy were exercised, to support an infinitely greater population than the present one into the very distant future. As indicating the possibilities for economy through efficient engineering sales work, proper construction and design of equipment, Mr. Insull pointed to the results which have been obtained by the Commonwealth Edison Company, which supplies all the energy requirements of all the local transportation companies in Chicago, as well as all lighting and power requirements. Chicago has between 2½ and 3 per cent of the total population of the country, while the energy generated there is more than 5 per cent of the total electrical energy produced in the United States. The generation results in 6 per cent of the gross income from the sale of electrical energy in the country and it is done on an investment which is only 3 per cent of the capitalization in the central station industry in the country.

Mr. Insull referred to the starving process to which many of the utility companies have been subjected and asserted that this could not go on with the expectation that the utilities could continue properly to function. The effect of such a policy was far greater upon a community than upon the company which is being crucified. Under such conditions great industrial efficiency is impossible.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Toledo Commission Active

Rushing Work on the Cost-of-Service Measure So Early Vote May Be Had

Members of the cost-of-service commission at Toledo, Ohio, have been busy adjusting their draft on an ordinance for the settlement of the Toledo railway difficulties to meet the objections pointed out recently by Henry L. Doherty on behalf of the Toledo Railways & Light Company, owning the lines.

Mr. Doherty's Suggestions Accepted

The commission has determined that whatever is submitted to the people for ratification must satisfy the Doherty interests first or be useless if adopted by the people. They are rushing the work so that an early vote on the terms of settlement may be had. In many sections of the ordinance the objections of Mr. Doherty have been found to be well taken and changes have been incorporated in the ordinance.

By the provisions of the latest turn in the Toledo situation, in which Judge Killits of the District Court granted a fare increase to the company so that a wage advance to the men might be allowed in order to restore railway service after a strike had been called, the company and city were granted the privilege of making application for investigation by the court to determine whether the fare now being charged is excessive or enough for a proper return on the investment.

The court set April 22 as the day for making such a request for investigation. Neither the company nor the city has shown any inclination to make a move in that direction. Whichever party asked for the hearing would have to furnish the bulk of proof.

Just Sustaining Life

It appears that the company, while not claiming to make a fair return on its investment, is obtaining revenues which maintain it in a living condition. The recent fare increase provided for the wage advances in a large measure and as long as these terms continue it is doubtful whether the company would aggravate the situation by asking for higher fares.

The city, on the other hand, while its Mayor and law director have been contending that the company is making excessive charges for power and other items, so that operation is not economical, has not seen fit to take unto itself the burden of proving these claims.

The court promised a thorough investigation which would be based on a valuation of the physical properties and investment of the company. The city officials fear that such an investigation of the court might set a basis for a valuation in the future which would be detrimental to the efforts of the city providing condemnation proceedings were brought in an attempt to buy the lines for municipal control.

The municipal ownership commission, which has been investigating a proposition to submit to the people at the same time a cost-of-service plan is put before them, is now considering the feasibility of a bond issue of about $2,000,000 for a motor bus system. Some members of the commission fear that the unsettled condition resulting from the ouster ordinance of last fall will be carried through the coming winter and that Toledo may again suffer a tie-up of transportation without any adequate relief. The bus system could, of course, be used as an auxiliary to the railway.

The commission has not yet submitted a report to the federal court.

130-Mile Interurban Project Approved

The Dallas (Tex.) Railway will build an interurban line from Dallas to Wichita Falls, a distance of 130 miles, in lieu of two lines, each at least 30 miles long, which the company contracted to build under terms of the franchise granted this company in 1917. The proposition was voted upon favorably in the municipal election in Dallas on April 6.

The Dallas-Wichita Falls line has been promoted by committees of Dallas and Wichita Falls business men, who have had surveys made by the Fred A. Jones Company, Dallas, and estimates covering cost of construction prepared. These committees have agreed to carry through the financing details of the proposition, which are already well advanced, and then turn over to the railway the uncompleted project, which the traction company agrees to have in operation by July, 1922. It is estimated that the completed line and its equipment will cost $9,500,000.

The line will run northwest from Dallas, touching Denton, Krum, Bowie, Henryetta, Wichita Falls and numerous smaller towns. The line would penetrate a zone of 2,400 square miles, with a population of 150,000 people now practically without railroad facilities. It would also connect with several trans-continental railway lines not now easily accessible to Dallas.

Subway Campaign Opened

Considerable Opposition Seems to Have Developed to Putting Through the Cleveland Plan Now

The subway bond campaign has been opened at Cleveland, Ohio, and members of the Rapid Transit Commission are addressing various organizations and bodies of business men on the subject. For some time the Cleveland *Plain Dealer* has been running a series of articles, detailing both the arguments in favor of the project and those against it. Up to this time they have dealt mostly with those favoring it.

Will Increase Taxes

The greatest objections yet advanced are the increase in taxes that will be required to take care of bond interest and the excessive cost of materials and labor at this time. Current loaning rates are 7 per cent and only recently it was found impossible to sell 5 per cent city bonds. This is the rate the subway bonds were expected to bear.

No action has been taken by the Cleveland Chamber of Commerce upon the adverse report made to it by the special subway committee. Because of a division of opinion among the members, it is said that the report may not be put before the body for its decision.

An adverse report was made to the Rapid Transit Commission by the Cleveland Association of Building Owners and Managers on April 14. The reason assigned for this step is that it is an inopportune time for the construction of such an improvement.

The Cleveland Building Trades Council has approved the construction of the subway as mapped out by the engineers. Business Agent Charles Smith said that the subway is needed for the development of home building outside of the high-rent district and to insure the employment to those people who are attracted to the city by the home building program.

Railway Commissioner Explains

Fielder Sanders, Street Railway Commissioner, has taken issue with a statement published recently to the effect that only twenty-five cars have been purchased by the Cleveland Railway during his administration. He shows that a total of 181 cars has been added during the years 1916, 1917 and 1918. No cars were purchased in 1919, because of the existence of war conditions. During the period mentioned 145 cars were scrapped, leaving a net gain of thirty-six. All the new cars and trailers, however, are of the largest size and contain the latest improvements.

Electrification Urged

Canadian Government Asked to Electrify Main Lines as Offset to Proposed Radial Systems

Electrification of the Ontario lines of the Grand Trunk and the Canadian Northern Railway systems now owned by the Dominion government was advocated in the Canadian Senate at Ottawa recently by Senator E. D. Smith, who declared such action to be necessary to avoid "frightful losses" which would otherwise result from duplication of existing railways by a system of Hydro-Electric Power Commission radials.

A $200,000,000 Project

Forty-seven municipalities have now voted in favor of the construction of 1,600 miles of hydro radials, the estimated cost of which is $200,000,000. One line to be constructed is between Toronto and Bowmanville, a 40-mile stretch already served by six railways, several of which are owned by the Dominion government. The cost of that section is estimated at $200,000 a mile.

Senator Smith argued that the people of Ontario are determined to have electric railway service, because of the advantages of speed and frequency, and unless the government is prepared to accept heavy losses on the federal system, he declared existing steam roads should be forthwith electrified.

Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, at whose behest the people have declared in favor of the radial scheme, at a recent conference with the Minister of Railways at Ottawa proposed a plan for co-operation between hydro radials and the Canadian National Railways system. He asked that Hydro be permitted to purchase the Niagara, St. Catherines & Toronto Railway, the Toronto & Eastern Railway, which runs to Bowmanville, and the Toronto & Suburban line to Guelph, thus to avoid construction authorized by the people, which would entail duplication.

Sir Adam Satisfied

Sir Adam also proposed the electrification of certain branch lines of the old Grand Trunk and the Canadian Northern Railway systems and the electrification of city terminals and their operation by the Hydro system. He urged that the hydro radials and electrified branch lines would serve as feeders to the main lines of the government system. Sir Adam Beck afterward announced that the results of the conference were "wholly satisfactory."

Substation Destroyed by Fire

Service on two railway lines at Toledo, Ohio, was held up for six hours on March 10 by the destruction of the Casino substation north of the city by fire of unknown origin. The loss to the Toledo Railways & Light Company is estimated by officials to be $50,000, about 90 per cent covered by insurance. The substation was located in a building that was once a hotel. Help from the city fire department arrived too late to save anything.

F. J. Derge, assistant general manager of the company, declared that the station would be rebuilt immediately and probably at a new location. The present site of the destroyed station may be again used for hotel purposes. The substation supplies all the power for the Toledo, Ottawa Beach & Northern lines and also the Point Place and Summit Street lines. It also served lighting customers in the northern section of the city and beyond the city limits.

Wages Increased in Appleton

Voluntary Wage Advance Provokes Favorable Comment by Daily Press on Railway Management

The Wisconsin Traction, Light, Heat & Power Company, Appleton, Wis., on March 8 voluntarily increased the wages of motormen and conductors on both the city and interurban lines and other employees directly connected with the operation of the cars 5 cents an hour. The increase dates from March 1. This makes the present scale 48 cents to 50 cents an hour. The action of the company came as a surprise to the men, inasmuch as they had received a substantial increase less than six months ago.

The issue of the Appleton *Post* for the day prior to that on which the increase in wages was announced contained an editorial which bespeaks the public attitude which good service begets. It reads in part as follows:

> Not the least of Appleton's assets is the Wisconsin Traction Light, Heat & Power Company. In making this favorable comment we refer in this instance particularly to the interurban line which it operates between Kaukauna and Neenah. We do not believe there will be found anywhere in the State of Wisconsin an electric railway operated with greater efficiency and with greater fidelity to the service of the public than this property. When other interurban lines throw up their hands in the face of storms and cold this company works ceaselessly to keep its road open, and actually does keep it open . . . .
> The record of the Wisconsin Traction, Light, Heat & Power Company is one to be proud of. The city and communities served by it are fortunate. It gives service in the best sense of the word—service that is dependable and accommodating.

New York Bills Defeated

The Jenks service-at-cost bills referred to previously in the ELECTRIC RAILWAY JOURNAL were defeated in the Assembly on April 22. The most important of the measures lacked ten votes of the required majority of seventy-six. The bills can, however, be brought up again for reconsideration on motion of their sponsor, Assemblyman Jenks. The vote on the first Jenks bill stood sixty-six for and seventy-seven against passage. On the second Jenks bill and the third, of relatively slight importance, the vote stood sixty-five for and seventy-eight against. The opinion seems to prevail at Albany that the defeat the bills sustained on April 22 is final.

Preparing Houston Grant

Service-at-Cost Measure, Growing Out of Fare Case, Being Drafted for Submission to Voters

The new franchise for the Houston (Tex.) Electric Company is expected to be ready for submission to the people for ratification in a few weeks. This franchise will be granted in line with the findings of Special Master Otis K. Hamblen and Judge Hutcheson of the United States District Court, holding that the present fares permitted the company are confiscatory and that the company should be permitted to earn a return of 8 per cent on its valuation of $6,000,000 as fixed by the special master. The company is charging a 7-cent fare for adults with 3½ cents for children and students. This fare went into effect on April 4 and will continue until the new franchise takes effect.

Dallas Being Copied

The new franchise is being patterned somewhat after the Dallas grant of 1917. Co-operation of the company and city officials will be one of the chief features of the new franchise. A commission of four, two city officials and two company officials, is proposed to audit the books and control the sliding scale of fare charges and earnings and supervise expenditures.

The fares charged are to be on a sliding scale and bear a definite and fixed relation to earnings. The company will be permitted to earn 8 per cent net on the $6,000,000 investment, to which will be added the cost of all improvements and betterments ordered by the board of control. There will be a stabilizing and reserve fund of $200,000 to which is to be added all earnings above the authorized 8 per cent on the property valuation and the 4½ per cent allowance for depreciation and upkeep, until this fund reaches $300,000. Any time earnings exceed these allowances fares are to be revised downward and any time the earnings fail to provide these allowances fares are to be increased. The fare adjustments are to be made quarterly by the board of control.

Paving Requirements Modified

The company is not to be compelled to pave the space between its tracks in the residential sections of the city, but is to fill such space with gravel or similar material that will enable vehicles to turn or cross thereon, but which will not invite drivers to drive thereon.

Municipal Ownership Bill Advanced

The bill of the city of Toronto, Ont., for the acquisition of the Toronto Railway and the operation of the road by a commission was approved by the private bills committee of the Legislature on April 8 with only one important change. The change gives the City Council power to pay the members of the commission a salary if it sees fit.

New Welfare Association at Louisville

Objects Are Collective Bargaining and Co-operative Welfare with Adequate Service to the Public

To attain the threefold object of adequate service to the public, welfare of the company and welfare of the employees, the Louisville Railway and the Louisville & Interurban Railroad and the employees of both companies will, on April 1, enter into a co-operative agreement. The organization is to be known as the Co-operative Welfare Association. Its purposes, as defined by the constitution, are collective bargaining and co-operative welfare. A clause under this heading provides that for the purpose of collective bargaining the companies will deal with no organization of its employees other than the Co-operative Welfare Association.

MEMBERSHIP in the organization is not to be compulsory and it is specifically stated that any member of the organization may join any union or other organization. Two classes of membership are provided, limited and active. The limited membership extends only to the participation in co-operative benefits, while active membership extends to all of the activities of the organization. Eligibility to membership requires that an employee shall have been with the company four months. It also provides that to be an active member, a man may not be an officer of the company, which is defined as follows:

1. In the transportation department: the chief despatcher, trainmaster, regular inspector, regular assistant carhouse foreman, carhouse foreman, or above.
2. In the maintenance of equipment department: the chief motor inspector, foreman of the interurban repair shop, foreman of the machine, carpenter, or paint shop, or above.
3. In the motive-power department: watch engineer, line foreman, or above.
4. In the maintenance of way and structures department: assistant foreman, foreman, or above.
5. In the clerical department: cashier, auditor, paymaster, superintendent of change and transfer room, chief adjuster of claims, or above.

SCHEME OF ORGANIZATION

The organization may take cognizance of wages, hours of service, conditions of service, through a series of committees, but all other activities of the transportation enterprise are outside the scope of the organization. All committees are to be composed of equal numbers of active members of the welfare association and persons appointed by the company, who need not be members. There will be local committees, departmental committees, and a general committee. Any matter on which a local committee cannot reach a decision will be referred to the proper departmental committee, and from this to the general committee.

If the general committee cannot reach a decision the matter must be submitted to arbitration. Any decision of a local or departmental committee is to be final except that the general committee by a majority vote of either side may call up for review any decision of a local or departmental committee. To reach a decision, a majority of company committeemen must concur with a majority of those representing the men, a majority meaning more than half of those present and absent. A quorum of any committee to do business is to be a majority present on each side.

The local committees will be composed of two active members from the welfare organization and two persons appointed by the company. Local committees will be organized as follows:

Transportation department: one at each carhouse.

Motive-power department: one at each power house, one representing substations of which one committeeman shall be a city operator and the other interurban, and one representing linemen.

Maintenance of equipment department: one for each of the following: paint shop, carpenter shop, machine shop, motor inspection, interurban repair shop.

Maintenance of way and structures department: one representing city trackmen and one representing interurban.

Clerical department: one from all of the various city offices and one from interurban clerks and agents.

At the first election all active members will be eligible for the office of local committeeman. Thereafter only those who shall have been continuously in the employ of the company twelve months and, in the transportation department, who, in addition, are assigned as trainmen to a regular run. The employees' representatives on the departmental committee are to be made up of the committeemen from each local committee who is elected by the highest number of votes, and an equal number of company appointees. The general committee is to be composed of delegates elected by the departmental committees from their own number, and an equal number of company appointees.

Meetings of the general committee are to be held at least monthly, for the consideration of adjustments, complaints and grievances, general welfare of the men and of the company, expenditure of the funds of the organization and all other business within the scope of the organization.

The constitution provides that in the event the general committee cannot reach a decision, the matter must be arbitrated. In this case the company will appoint one arbitrator, the Welfare Association members of the general committee another, and these two are to elect a referee, the decision of the majority of the three being final.

Funds for conducting the organization are to be provided by contributions from the company and dues of the members. The amount of dues is to be determined by the Welfare Association members of the general committee and the amount of the company contributions is to be determined through negotiation of the general committee with the board of directors of the company.

The idea behind the movement in Louisville is to create an industrial democracy in the electric railway industry of the city. With this in mind, the concluding provisions of the constitution are interesting:

This constitution proposes an industrial experiment. We, its framers, believe in the success of our undertaking. But we realize that we are not infallible, and we are conscious of a lack of experience in dealing with industrial democracy.

The only way that we can suggest to obtain a workable form of industrial democratic government is to try something; if it works, well and good—if it doesn't work, try something else. Therefore, it is provided:

1. If, at any time within three years, either side is dissatisfied with this constitution, it may withdraw therefrom by giving six months' notice of such withdrawal to the other side: after three years, by giving twelve months' notice.
2. In considering withdrawal, the company acts by a majority of all its directors, the men act by a majority of all their committeemen, held at a joint meeting of general, departmental and local committees.

Detroit United Stands Its Ground

The Street Railway Commission of Detroit, Mich., has addressed a letter to the Detroit United Railway asking its intentions relative to the St. Jean Avenue extension. Although the Mayor's opinion was that the Detroit United Railway would not be interfered with until the city lines were well under way, the letter to the company at this time is expected to bring a statement as to the company's attitude relative to the city's acquiring the lines built or being built on the day-to-day plan.

The proposed St. Jean extension was approved by the Council in May, 1919, but has not been completed. It is one of the much needed east side lines. The resolution of the Council giving the company the right to construct the line states that the Council or the people of Detroit may revoke the permit thereby granted and that the company must forthwith remove from the streets the property placed therein.

According to the agreement, the company is required to sell the lines to the city at cost of construction less depreciation, upon request by the city. It is the belief of the commission that the company will sell rather than remove its tracks from the streets where the work is already completed. In case the price to be paid by the city cannot be agreed upon with the company, the agreement provides for a board of arbitrators composed of three members, one chosen by the company, one by the city and one by the first two.

The Detroit United Railway maintains that it is the bounden duty of its management to direct its efforts in behalf of the continuation of uninterrupted service and that service to be the best possible at the lowest possible price. A purchase of the properties as a unified city system with the proper continuation of the interurban service represents an honest course which the company officials have always been willing to have carried out, but they state that "blackjacking first one line and then another, that the investors may in the end be robbed of their property, shall never receive their consent."

Strike Threatened in Pittsburgh

A strike of trainmen in Pittsburgh, Pa., seems almost inevitable. The receivers for the Pittsburgh Railways declare that they cannot possibly grant the demands for a 75 per cent wage increase, and the trainmen declare they will quit work on May 1.

The present agreement between the men and the receivers expires on April 30. Under this agreement the trainmen are receiving 49, 52 and 54 cents an hour, according to length of service. The new demands, which the men want made effective on May 1, include wages of 86, 89 and 91 cents an hour, with an eight-hour day. The company granted an increase of 10 per cent voluntarily, effective on April 1. This was made possible by the approval of the 7½-cent fare by the Public Service Commission of Pennsylvania. To meet the new rate of pay demanded by the trainmen an increased fare amounting to 12½ or 15 cents will be necessary, according to the receivers. They are reluctant to raise the fare.

The question whether the demands of the trainmen should be granted was put up to the public on April 17 by the receivers in a letter to Mayor E. V. Babcock and the City Council. The letter states that under the present fare charged on the lines of the Pittsburgh Railways it would be impossible to grant the demands of the trainmen, and that the receivers are prepared to receive and consider the suggestions of the public as to the wisdom and advisability of acceding to demands that would entail an increase of from 75 per cent to 100 per cent in fare.

In reply to this, the trainmen accused the receivers of "passing the buck" to the public.

Mayor Babcock replied to the receivers on April 20 that he had nothing to do with the controversy between the receivers and the men; that the matter rested with them, the United States District Court and the employees who operate the cars. He voiced opposition to an increased fare, and said a strike would be calamitous. Mayor Babcock decided to take this attitude after a conference with the Council.

Thirty-five Cents Advance Asked in Chicago

Two thousand trainmen of the Chicago Surface Lines attended a meeting of their union on April 19 and approved the report of their committee asking an increase of 35 cents an hour in the wage scale and no changes in working conditions or hours. This means that their demand will call for the payment of 95 cents an hour for men three months in service, 98 cents for the next nine months, and $1 for those in service over one year. Night car men, who now receive 67 cents, would be entitled to $1.02 on this new scale.

The agreement now in force was effected after a strike last August. Members of the Public Utilities Commission acted as arbitrators, and established a wage scale of 60, 63 and 65 cents an hour. Sixty per cent of the runs were put on a straight eight-hour basis, the balance to be completed within fourteen consecutive hours and no run to pay less than eight hours' time. Payment for overtime is at the rate of time and a half.

The present contract expires June 1 and the union was required to notify the company of any proposed change before May 1. Following the establishment of the 65-cent maximum wage last year, the Public Utilities Commission allowed the companies to charge a 7-cent fare, which was subsequently reduced to 6 cents. Hearings on the valuation which is to be the basis for a permanent rate of fare are still in progress. All the companies' figures have been on the basis of cost to reproduce new, while the city's lawyers have been seeking to prove a depreciated value.

International Railway Rejects Men's Demands

After a series of conferences with representatives of its employees, the International Railway, Buffalo, N. Y., has rejected the demands of the union employees for a wage advance of approximately 100 per cent. Other demands of the union were also turned down. The company offered the men an increase of 12 cents an hour. This would increase the payroll about $1,000,000 a year.

The railway refused the demand for a closed shop and refused to grant an eight-hour workday and other concessions asked by representatives of the employees who are members of the Amalgamated Association. Negotiations, however, will be continued by the company and its employees. The present agreement expires on May 1.

In a statement announcing the company's attitude and the offer to increase the wages 12 cents an hour, Herbert G. Tulley, president of the railway, says that the company's employees must always retain their freedom of action and "themselves elect whether or not they become members of your association. Your request for a closed shop is, therefore, denied."

Continuing, the statement of President Tulley says:

> The eight-hour day with time and a half for overtime, payment for time not worked and the other suggested changes which increase costs cannot at this time be considered. Wage increases requested and other requested allowances would increase the company's payroll more than $4,000,000 per annum. Wages so increased would then alone consume the entire gross earnings of the company. The wage increase of 12 cents an hour allowed by the company will approximate $1,000,000 a year. This is the amount of increased revenue expected from the 7-cent fare, and consequently represents the maximum increase possible of payment.
>
> The rates of pay for motormen and conductors shall be as follows from May 1, 1920 until May 1, 1921. First three months 83 cents an hour, for the next nine months 86 cents, and after one year, 88 cents an hour.
>
> Rates of pay for engineers, conductors and brakemen in freight service; motormen and conductors in flat car service, and motormen and conductors in package express service shall be as follows: Engineers and motormen, first three months, 88 cents an hour; next nine months, 91 cents, and after one year, 93 cents. Conductors, first three months, 88 cents; next nine months, 91 cents; after one year, 93 cents. Brakemen, first three months, 84 cents; next nine months, 87 cents; after one year, 90 cents.

The complete schedule of wages asked by International employees follows:

> Rates of pay for shopmen, carhouse men, power house men, bridge and building department men, curve cleaners, baggagemen, watchmen, ticket agents, agents of the Buffalo, Lockport & Olcott division, freight handlers, emergency men and all others covered by this agreement, and others who are members of the association in the employment of the company, shall be increased at the rate of 40 cents an hour, effective May 1, 1920, and to last until May 1, 1921.

New York-New Jersey Tube Service Resumed

During the general transportation strike in New York there was considerable talk about the possibility of the employees of the city railways in the metropolitan district joining the strikers. None of these men, however, went out. Among the heavy traction roads affected by the strike was the Hudson & Manhattan Railroad, operating under the Hudson River between New York and New Jersey and to Newark. Operation of the tubes, however, was resumed on April 19 almost simultaneously with an announcement from the officials that they had put into effect the increased fares authorized by the Interstate Commerce Commission.

Oren Root, president of the company, in announcing service resumption, said:

> Up to this time we have not had sufficient men properly qualified to operate our trains and we have, therefore, been unable to re-establish our service. As previously stated, we did not think it safe to operate our service with inexperienced men.
>
> We have already been granted an increase of fares by the Interstate Commerce Commission, and I do not see how that question can be brought into the present situation. We have no intention of making application for any additional increases.

President Root estimated that 500 trainmen had walked out, and asserted that approximately seventy-five of the strikers had returned to their jobs. The motormen had not joined the strikers, consequently the company, with the new men, the seventy-five who have returned and those who remained at their posts, had been able to resume a partial operation of trains.

The new fares are 6 cents from points in New Jersey to the Hudson terminal in downtown New York and 10 cents to stations above the Hudson Terminal.

Change in Magazine Name

The *Em-an-Ess Electric News* will hereafter be known as the *Penn-Ohio Electric News*. The paper is published by the Pennsylvania-Ohio Electric Company, formerly the Mahoning & Shenango Railway & Light Company, and the change in name of the paper was considered desirable on account of the change in name of the company itself. A first prize of $10 was offered for the best suggestion. The award was made to Donald S. Jones, night ticket agent at the Boardman Street office.

Arbitrators Chosen in Boston

Both Eastern Massachusetts and Boston Elevated Wage Disputes Are Being Prepared for Arbitration

Hugh Ogden has been selected as the third arbitrator and chairman of the board to which has been referred the wage increase demands of the employees of the Eastern Massachusetts Street Railway, Boston, Mass. The other arbitrators are James H. Vahey, counsel for the union, representing the employees, and Philip G. Carleton, counsel for the company, and its representative on the board. Mr. Ogden is a well-known Boston attorney.

The arbitrators will devote their entire attention practically to the question of wages, the trustees of the company being opposed to granting the full demands of the employees for an increase from the present maximum of 51 cents an hour to 75 cents an hour. Both sides have agreed to abide by the board's decision.

All of the other matters included in the employees' demands, such as wage schedules, etc., will be denied, it is expected, by conferences between the joint board of the men's unions and R. B. Stearns, vice-president and general manager, and other officials of the company, which are now being held daily. Such items as cannot be decided by them will be referred to the arbitrators.

COUNSEL BARNUM TO REPRESENT "L"

The board of trustees of the Boston (Mass.) Elevated Railway has appointed H. W. Barnum, counsel for the company, as arbitrator for the conference to be held this month called for the purpose of establishing a new wage schedule.

James H. Vahey, counsel for the carmen's union, will act for the men.

The board of trustees has decided to settle as far as possible by means of direct negotiations all questions coming up for discussion. Several conferences have been held to date, with W. D. Mahon, president of the Amalgamated, presenting the case for the men. Each item will be taken up and discussed and settled if possible. If an agreement cannot be reached, the case will be submitted to the arbitration board.

The two members selected will meet shortly to choose a third member, who will act as chairman of the board.

Little Progress in Cleveland Dispute

A conference between representatives of the platform men and officers of the Cleveland (Ohio) Railway took place on April 16. It was called at the request of the men, who desire to arrive at an understanding with the company on the demands made by both sides. The men want to reopen the contract, which is subject to change after May 1. In his reply to the demands submitted recently, J. J. Stanley, president of the company, questioned the wisdom of reopening the contract at this time and said that the demands made by the men are unfair to the public.

After the meeting, officials of the local branch of the union stated that they still had hopes of arriving at some conclusion that would make arbitration unnecessary. It is probable that another conference will take place this week.

C. Loomis Allen has been selected to represent the Cleveland Railway in the arbitration of the wage question.

Mr. Mahon Appeals for Loyalty

In an open letter to the officers and members of the local divisions of the association, International President Mahon, of the Amalgamated Association of Street Electric Railway Employees of America, has appealed for the exercise of good judgment and sound reason and the fulfillment of their promises during these times of "outlaw" strikes and general unrest. President Mahon's letter is as follows:

I take this means of appealing to you to ask that you be not misled by the present agitation for a general or sympathetic strike.

This is the hour when good, sound judgment and good reason must prevail. You have contracts that have been established after years of hard and patient labor by the officers of your association, and these conditions must not be foolishly cast aside or lost by following false promises from irresponsible persons who know nothing of your conditions.

I therefore appeal to you to remain loyal to your contracts, uphold the laws of your association and be in a position to march forward in the future as you have been in the past, securing better positions and upholding the true standard of American labor.

News Notes

Carhouse Destroyed in Ohio.—The carhouse and eleven cars of the Dayton & Troy Electric Railway, Tippecanoe City, Ohio, were destroyed by fire on April 14. The loss was placed unofficially at $150,000.

Non-Union Employees Insured.—The British Columbia Electric Railway, Ltd., Victoria, B. C., has insured all its male office employees who have been a year in the service and who are eighteen years of age or more. The amount of the benefit is $1,000. The insurance does not cover any one who is a member of a railway, light and power or gas union.

Coinage of 8 and 7-Cent Pieces.—A bill has been introduced in the United States Senate by Senator Frelinghuysen of New Jersey, directing the coinage of 7-cent pieces and 8-cent pieces. One of the arguments which has been used in favor of the production of such coin is that they will simplify the payment of railway fares in these denominations.

Jim Crow Law Upheld.—The Supreme Court of the United States on April 19 sustained the Kentucky separate coach act requiring the separation of white and negro passengers and holding that it applies to the South Covington & Cincinnati Street Railway and the Cincinnati, Covington & Erlanger Railway while operating between points in Kentucky.

Wage Demands Made in New Hampshire.—The Manchester (N. H.) Traction Company employees and the trainmen in the employ of the Concord Electric Railway are asking for an increase of 10 cents an hour and a 25 per cent increase for shopmen and trackmen. The trainmen at Concord were increased last September from a scale of 36 cents and 43 cents to a scale ranging from 45 cents to 55 cents.

Demands of Interurban Men Rejected.—J. F. Collins, general manager of the Michigan Railway, is reported to have stated that it is impossible for the company to meet demands made upon it by the men engaged on the interurban lines operating out of Grand Rapids. Among these demands are a closed shop, 85 cents an hour for the first six months for motormen and conductors after June 1 and 90 cents an hour after the first six months.

No Intention to Electrify.—C. E. Ingersoll, president of the Midland Valley Railroad, which extends from Wichita, Kan., to Ft. Smith, Ark., denies that there is any intention on the part of the management to electrify the road. He explained that the Midland Valley is primarily a coal road. In addition to serving a rich coal region in eastern Oklahoma and western Arkansas, the railroad owns some of the very best coal producing properties in the district which it serves.

New Wage Scale Presented at Wheeling.—The electric railway employees of the Ohio Valley submitted their new wage scale to the companies at Wheeling, W. Va., on March 30, the new scale to go into effect on May 1. It is understood that the new scale calls for an approximate increase in wages of 25 per cent, with changes in working conditions. The new scale affects the motormen and conductors, the electric linemen, trackmen, barnmen and others. It is understood that a counter proposition is to be submitted by the companies.

Toledo Lines Kept Running.—Judge Killits again kept the cars of the Toledo Railways & Light Company, Toledo, Ohio, running when a shortage of coal due to the "vacation" of switchmen and yard employees, tying up all of Toledo's twenty-three railroad lines, nearly closed the powerhouse. The court issued an order allowing the company to confiscate up to forty cars daily of coal, in yards at Toledo, destined to northern points. The Toledo Railways & Light Company provided its own engine for switching the coal.

Publicity Campaign at Little Rock.—The Little Rock Railway & Electric Company, Little Rock, Ark., through the daily press is running a publicity campaign on the merits of electric traction. "Daring Not Always an Admirable Quality" is the caption of one of the discourses on travel. The distinction is made between daring for a good cause and purpose and the reckless pest who menaces his own and others' safety.

"Jack" Dempsey Acquitted in Wreck Trial.—John J. Dempsey, formerly vice-president of the Brooklyn (N. Y.) Rapid Transit Company, was acquitted by a jury in the Supreme Court at Mineola, Long Island, on April 14 on an indictment charging him with manslaughter in connection with the death of Thomas Gilfeather in the Malbone Street, Brooklyn, tunnel wreck on the night of Nov. 1, 1918. The jury in the first trial failed to agree on a verdict. The accident followed a strike on the road. More than ninety persons were killed in the wreck.

Preparing for M. O. Charter Amendment.—In accordance with the declared intention of Mayor Rolph of San Francisco, Cal., in his election platform to submit the purchase of the United Railroads to the people City Attorney George Lull has begun the consideration of a charter amendment to this end. Unless a charter amendment is submitted at the coming election in November the whole matter will have to go over for two years. The Mayor is desirous, if possible, of disposing of the acquisition of the United Railroads during his present term of office.

Commissioners Will Contest Removal.—The members of the Board of Public Utility Commissioners of New Jersey have decided to go into the courts to prevent, if possible, an investigation of the board by Governor Edwards. Notice to this effect was served upon the Governor by Utility Commissioner Andrew Gaul, Jr., who applied to the Supreme Court for a writ to review the record and proceedings in the complaint of Jersey City against the commission. The city asks that the commission be removed from office for alleged misconduct and neglect of duty.

Ottawa Wages Being Negotiated.—Negotiations are under way between the Ottawa (Ont.) Railway and its employees, in connection with a request by the latter for an increased schedule of wages to come into effect on May 1. While the executives of the union have given out no official information, it is learned that the company is being asked to grant a maximum wage of 65 cents an hour. The present maximum, granted following the trouble and consequent disastrous strike last summer, is 45 cents an hour. It is said that both sides believe a satisfactory arrangement will shortly be reached.

No Demands by Montreal Men.—The present working agreement between the Montreal (Que.) Tramway and its employees does not expire until June 30. So far there has been no application on the part of the men to the company for higher wages. Applications would go to the company in the first instance, but a study of the contract between the company and the city of Montreal, as approved by the Legislature and creating the Tramways Commission, shows that in the end it would be the commission which would have the say, for it is this body which makes the allowances to the company as to the various amounts to be expended for each account.

Arbitration Decided Upon in Washington.—There will be no strike of the union employees of the Washington Railway & Electric Company and Potomac Power Company, Washington, D. C., at this time. The differences between the men and the companies will be submitted to arbitration. This decision was made on April 17 at a meeting of the Amalgamated Association. The vote followed presentation of a letter from William F. Ham, president of the companies, to Secretary of Labor Wilson offering to arbitrate. The next step is a conference between President Ham and a committee from the association. It is probable that a board of arbitration will be selected by May 1.

Wage Agreement at San Antonio.—An agreement has been reached between officials of the Public Service Corporation, San Antonio, Tex., and its trainmen, whereby the wage scale for conductors and motormen who have been in the service of the company for one year or longer will be 51 cents an hour and the pay of men in the service less than a year will be 49 cents an hour. This is an increase of a little more than 20 per cent. Employees in the sheds, carhouses and elsewhere receive substantially the same percentage of increase. Nine hours, under the agreement, will constitute a day's work. Time and a half will be paid for overtime.

Electrification of Jamaica Railways.—The Westinghouse Electric International Company has submitted to the Government of Jamaica an estimate of the proposed electrification of the railways on the island and the proposal to provide electrical power for industrial purposes. It is estimated that power plants would cost $849,000, substations $333,000, overhead construction $1,850,000 and electric locomotives and other motor equipment $357,000, a total of $3,489,000. The cost of operating the railway would be about $260,000 yearly, or about 7.7 per cent of cost of electrification. The sale of current to outside consumers could probably be conducted at a profit which would increase the return on the investment to about 10 per cent.

Change in New Arlington Station Plans.—The board of trustees of the Boston (Mass.) Elevated Railway has approved the change in plans providing for a second entrance to the new Arlington Street station. The new plans call for an entrance at Berkeley Street, which will require the construction of a passage about 350 ft. long. The advantage gained by this addition is to provide a more convenient entrance for the district now fast developing in the neighborhood of Stuart and James Streets. The contract for the construction of the station has been awarded to the Hugh Nawn Construction Company, Boston. It is not expected that the change in plans will delay the opening of the new station, which is scheduled to take place at the beginning of next year.

Will Remain True to His Trust.—Sydney L. Wright, Philadelphia, president of the New Jersey & Pennsylvania Traction Company, Trenton, N. J., was summoned to Trenton recently to confer with J. H. Twitchell of New York and representatives of the union in an attempt to adjust the wage question. President Wright said: "We are under obligation to the public to maintain our franchise. We carry the United States mails and about 10,000 quarts of milk daily for Trenton families. We are not going to betray our trust to the public and we are not going to increase wages. If we paid the increase we would have to increase the fares to 10 cents and this we are unwilling to do." The men are asking for a 25 per cent increase.

$1 an Hour Asked at Detroit.—New demands by the trainmen of the Detroit (Mich.) United Railway will be presented to the company on or before May 1 according to action taken by the men at their meeting on April 17. The employees instructed a committee to present a request to the company for an eight-hour day with time and a half for overtime and all Sunday and holiday work. The following wage scale will be demanded: 95 cents an hour for the first three months; 98 cents an hour for the next nine months and $1 an hour thereafter. No statement was made regarding the company's attitude in the matter as it was maintained that no opinion could be expressed until the demands of the men had been officially presented to the company.

Cost of Pasadena-Los Angeles Line Reduced.—The proposed municipal electric railway between Pasadena and Los Angeles, Cal., can be built for $1,000,000 less than the estimate recently made by R. V. Orbison, former city engineer. This is the finding of the board of engineers appointed by the City Commission to pass on Mr. Orbison's estimate. The report of the engineering experts was filed with the City Commission by Commissioner John J. Hamilton. Instead of costing $3,919,689, as estimated by Mr. Orbison, the board of engineers report that the line can be built and constructed exclusive of the right-of-way for $3,465,867, or a saving of $453,822. The principal saving in construction in this proposed line is made by changing the right-of-way so as to avoid two costly tunnels. The report as filed by Commissioner John J. Hamilton was referred to the committee of the whole without any comment.

Financial and Corporate

Holds Normal Gain in Net

Hawaiian Company Still Meeting Cost of Service Without Increase in Rate of Fare

That the Honolulu Rapid Transit & Land Company, Honolulu, Hawaii, had a fairly prosperous year is reflected in the very complete annual report recently issued covering operations for 1919. The revenue from passenger transportation was 95.2 per cent of the gross earnings. It showed a 6.53 per cent increase for the year, although the months of January and February were lean owing to the "flu" epidemic.

The number of passengers carried increased 6.43 per cent, or slightly more than 900,000. The average number of passengers carried daily approximated 42,000, of which 24 per cent used transfers. The increase in revenue on the various routes ranged from 4.57 to 12.63 per cent.

Freight tonnage increased 27.2 per cent for the year but the revenue failed to hold the increase. This would indicate that the average rate for the increased business was below the average heretofore handled, this causing a decrease of 0.305 per cent in the average rate per ton.

The operating ratio did not increase materially, but the cost of power and conducting transportation increased sufficiently to offset the saving made in maintaining way and structures.

INCOME STATEMENT OF HONOLULU COMPANY

Year Ended Dec. 31	1919	1918	Per Cent Change, + Inc., — Dec.
Passenger revenue	$742,275	$697,278	+ 6.45
Special car revenue	1,655	966	+ 7.14
Mail car revenue	225	220	+ 2.27
Freight revenue	10,465	8,212	+26.75
Total railway operating revenue	$754,620	$706,676	+ 6.71
Way and structures	$54,291	$67,802	—19.80
Equipment	48,933	38,639	+26.60
Depreciation	67,437	67,285	+ 0.23
Power	77,605	59,172	+31.30
Conducting transportation	212,269	193,777	+ 9.54
Traffic	7,048	10,361	+ 3.19
General and miscellaneous	55,549	52,833	+ 5.14
Total operating expenses	$523,132	$489,869	+ 6.80
Net operating revenue	$231,488	$216,807	+ 6.76
Taxes and car licenses	64,152	61,818	+ 3.76
Operating income	$167,336	$154,989	+ 7.96
Non - operating income	26,326	28,475	— 7.57
Gross income	$193,662	$183,464	+ 5.56
Interest — bills payable	8,400	6,695	+25.48
Net corporate revenue	$185,262	$176,769	+ 4.81
Dividends	$160,000	$160,000	.....
Sinking fund reserve	107,314	93,426	+14.86
Loss and gain	.....	2,929	.....
Deficit for year	$82,052	$79,586	— 3.86

STATISTICAL INFORMATION

	1919	1918	Per Cent Change + Inc. — Dec.
Average total miles operated	30	30	.....
Car-miles	2,115,575	2,082,133	+ 1.605
Car-hours	222,369	218,920	+ 1.572
Rev. passengers (a)	15,225,168	14,304,489	+ 6.43
Transfer passengers	3,703,350	3,407,229	+ 8.68
Free fares	158,268	177,219	—10.68
Total traffic	19,086,786	17,888,937	+ 5.67
Gross passenger revenue	$743,931	$698,244	+6.54
Average fare:			
Per revenue passenger (cents)	4.88	4.88	.....
Per total passenger (cents)	3.905	3.91	.....
Operating ratio (per cent)	69.39	69.35	.....
Car-mile statistics:			
Operating revenue (cents)	35.67	33.94	+ 5.1
Operating expenses (cents)	24.75	23.50	+ 5.3
Net income (cents)	8.75	8.46	+ 3.43
Passenger traffic	9.015	8.57	+ 5.24
Car-hour statistics:			
Operating revenue	$3.510	$3.358	+ 4.53
Operating expenses	$2.355	$2.235	+ 5.37
Net income	$0.833	$0.806	+ 3.34
Passenger traffic	$ 85.7	$ 81.6	+ 5.03
Ratio car-miles to car-hours (m.p.h.)	9.52	9.52	.....
Taxes—per cent of gross revenue	8.22	8.41	—2.26
Freight traffic:			
Tonnage handled	33,331	26,213	+27.20
Revenue	$10,689	$8,432	+26.75
Revenue per ton (cents)	32.069	32.167	— 0.305
Wages paid conductors and motormen	$197,677	$180,776	+ 9.37
Per car-mile (cents)	9.34	8.65	+ 7.98
Per car-hour(cents)	89.00	82.40	+ 8.02

(a) Full fares, half fares and chartered cars.

Increased power cost was due principally to the higher contract price for fuel oil, which advanced from $1.60 to $2 per barrel. The following table shows the cost of producing power the last two years:

	1919	1918
Wages	$13,492	$11,817
Fuel	61,585	43,754
Lubricants and waste	747	949
Miscellaneous repairs	1,781	2,653
Total	$77,605	$59,172
Kilowatt-hours produced	5,122,527	4,910,921
Average cost per kw.-hr. (cents)	1.515	1.205
Barrels of fuel oil consumed	30,351	28,105
Kilowatt-hours per barrel of oil consumed	168.78	174.73

Details of the cost of track and paving maintenance together with similar figures for the distribution system follow:

OVERHEAD DISTRIBUTION SYSTEM

Maintenance and rehabilitation:	1919	1918
Labor	$4,730	$4,375
Material	2,379	3,432
Poles—Maintenance:		
Labor	1,355	818
Material	2,864	1,982
Total maintenance distribution system	$11,328	$10,607
Feet of trolley wire replaced	6,747	5,000

WAY AND STRUCTURE COSTS

Track maintenance and rehabilitation:	1919	1918
Labor	$12,833	$14,952
Material	5,991	14,301
Paving maintenance and rehabilitation:		
Labor	5,907	5,629
Material	6,439	8,129
Superintendence of way and structures	5,358	6,239
Cleaning and sanding track	4,495	4,131
Storm work	64	1,110
Total—Track and paving maintenance	$41,087	$54,490

Conference on Ways and Means of Financing

The Public Utilities Commission of Illinois realizes that unless the utilities of the State are able to raise money promptly to finance indispensable extensions and enlargements to plant and equipment, the public will be put to serious loss and inconvenience. In order to find out what remedies the utilities and others have to suggest, the commission has issued an order for hearings in Chicago on April 29 and in Springfield on May 3, at which the question is to be discussed. These hearings were requested by utilities which have been unable to finance extensions ordered by the commission and also at the request of other utilities which have been unable to raise the money to finance additions and improvements which they consider necessary in order to keep up with the needs of the communities served.

In discussing this situation with a representative of the ELECTRIC RAILWAY JOURNAL, James H. Wilkerson, chairman of the commission, said:

> The financial problems of the utilities of the State are independent of questions of their financial stability or of the rates charged for service. The companies say they are unable to get money by the sale of securities on any reasonable terms and the commission must consider how far the utilities are to be required to make extensions under such financial conditions. The difficulties of the companies as presented to the commission are twofold. One is due to the general financial condition of the entire country. The other is local and has to do with the credit of this State where the misuse of public utility questions for political purposes has made people with capital afraid to invest in the securities of the utilities.
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> In other words, the utilities which serve the public of this State are drifting into the conditions of the railroads when they were unable to meet the demands of the public for adequate service. Very little new construction was undertaken by utility companies during the war, and additional equipment is needed to meet the greatly increased demands for all kinds of public utility service. Unless something is done promptly, the public will suffer severely, as the companies cannot respond to the public demand without money. Notices of the two hearings have been sent to all interested utilities, civic associations and municipalities so that every one concerned will have an opportunity to present complaints, submit evidence and make suggestions to the commission.

$91,076 Profit in Boston for March

The statement of the board of trustees of the Boston (Mass.) Elevated Railway for the month of March shows a net profit of $91,076. Applying this amount to the accumulated deficit, there remained on March 31 an accumulated deficit of $661,266. This, it is expected, will be wiped out by the beginning of the fall period.

The total cost of operation for the month of March was $2,142,208. Of this amount, $1,399,766 represents wages, $118,115 was required for the removal of snow, $294,697 was required for the maintenance of track and line equipment, $277,405 for power and the remainder for general expenses incurred in operation.

The total receipts were $2,927,022, and the total cost of service $2,835,946. The cost per passenger was 9.723 cents, of which 4.799 cents was for labor.

One-Man Cars Proposed for New York City

Stone & Webster Report on New York Railways Suggests One-Man Cars for Entire Base Load of Company—Flat Fare with Free Transfers Recommended—Interborough Upheld

Stone & Webster have submitted a report, under date of Jan. 1, 1920, to Job E. Hedges, receiver, New York Railways, which analyzes the present condition, operating methods and financial situation of the New York Railways and makes recommendations looking toward financial relief and increased operating efficiency. The outstanding features are an increase of fare to be made with the retention of the flat fare and with free transfers, a service-at-cost franchise basis, and the adoption of one-man cars to carry the base load of the system. The report is made in compliance with a request from Mr. Hedges, under date of May 31, 1919, since which time there have been numerous changes in the situation of the New York Railways arising out of the partial disintegration of the system, and it has been impracticable to amend the report in all respects in accordance with these changes. Consequently, the report is based upon conditions as of June 30, 1919, and none of the changes that has occurred since that time has been taken into account except the general 25 per cent increase in wages effective on Aug. 17, 1919, and the 2-cent charge for transfers.

THE report is introduced by a summary of the findings and principal recommendations and contains extended arguments and discussions, with supporting data, on the various points which the report includes



GROSS REVENUES—1909-1919

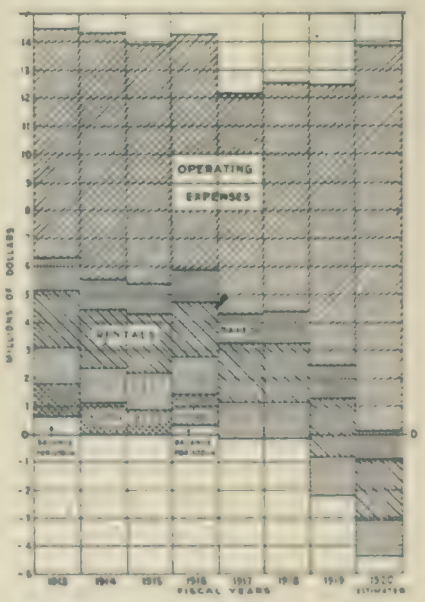
and upon which recommendations are made. A large number of charts, maps and diagrams are included in the report to complete the analysis.

A detailed examination of the physical property of the company and its subsidiaries shows the entire property in fair operating condition except the 96th Street power station, which, however, has not been operated for four years. It appears inadvisable to expend $500,000 to put this plant in operating condition, particularly as it could not even then produce power as cheaply as it can be purchased. The engineers do find, however, that the condition of the track is such as to demand large amounts for renewal jobs for which the company has not heretofore been able to accrue any cash reserves whatever. In other words, there is a deferred maintenance on track of approximately $13,000,000, which should be expended by 1926. The maintenance standard of the system as carried out up to four years ago is expressed as good, but the maintenance standard has apparently dropped off due to the necessity of retrenchment until it can now be expressed as only fair. One of the reasons given for the present condition of track over subway is that after subway construction, the track has never been left in fairly satisfactory condition.

Since 1916, the gross earnings have gone down steadily until within a few months, due to rapid transit competition, wartime, labor troubles, and the like, the car-miles have been cut so as to increase steadily the gross revenue per car-mile. The Third Avenue system has made a more drastic cut, but it is not evident that the New York Railways could have cut any further than it did. The gross passenger revenue per car-mile increased from 1916 to 1919 from 38.94 cents to 45.58 cents, while the increase for the corresponding period on the Third Avenue system was from 38.6 cents to 53.9 cents. The average cost per revenue passenger has risen from 5.88 cents to 7.58 cents in the same period, while the average gross earnings per revenue passenger have changed only from 4.87 cents to 4.88 cents.

As a means of increasing gross revenue until it exceeds gross operating expense, the engineers suggest several steps, the principal one of which is the adoption of the one-man safety car to carry the twenty-four-hour base load of the system. An immediate purchase of 110 of these cars is suggested, with an ultimate purchase of at least 550. There is an estimated annual saving of more than $400,000 in operating expenses which should result from the use of these one-man cars. Sufficient additional two-man cars would, of course, have to be provided during rush hours to compensate for the amount by which the aggregate and maximum capacity of the safety cars is less than that of the two-man cars which they would replace.

There is an extended argument in support of the recommendation for the adoption of the one-man car, data being given to show the saving in power cost, the saving in platform expense, the saving in car maintenance, and an argument indicating that there would be an increase in gross. Double-end one-man cars are recommended. Assuming the favorable financial showing, the cars must be "proved in," so to speak, to New York traffic conditions. Extended traffic studies were made and typical busy corners in New York were compared with typical busy corners in other cities in which one-man cars are already operating, notably Seattle, Wash.; Kansas City, Kan., and Bridgeport, Conn. At the intersection of Main and Fairfield Streets in Bridgeport, for example, a total of 1,261 vehicles, including street cars, pass in one hour. The intersection at this point is only 38 x 33 ft. Safety cars operate over this intersection satisfactorily and are handled more easily than the double-truck cars that operate over the same tracks. At Broadway and Forty-second Street in New York only 1,173 vehicles, including street cars, pass



DISTRIBUTION OF GROSS INCOME, 1913-1920

during the busy hour of the day, the intersection at this point being 55 x 50 ft. This and other data seem to indicate that the one-man cars can navigate in traffic as congested as found in New York.

That the one-man car is adaptable to the underground trolley system is attested by J. S. Doyle, superintendent of car equipment of the New York Railways. That the public will like the car is indicated by testimony from other companies, the questionnaire results of the American Electric Railway Transportation and Traffic Association showing 96 per cent of the communities in favor of it being quoted. As to the attitude of trainmen, results of the canvass under the same questionnaire show 89.2 per cent favorable. The fact that one-man cars climb successfully

the steep hills in Seattle and in Bangor, Me., indicates no difficulty on such grades as are found in New York.

As to other operating economies, the report finds that the company is already doing what it can in power saving by coasting recorders, by using the turnback, and by accident prevention. It finds the skip-stop inapplicable to New York conditions and suggests that a part of the special taxes should be remitted by the city. Information is quoted showing that the New York Railways pays in taxes 4.92 cents per car-mile as compared with 2.19 cents for the Philadelphia Rapid Transit Company and 1.86 cents for the United Railroads of San Francisco.

New Capital Needed for Cars

There is no apparent immediate necessity for new capital, except for the purchase of one-man cars. These, it is suggested, should be financed through equipment trust certificates and paid for out of earnings from the savings in operation. It is pointed out, however, that the present rate of fare is insufficient to furnish funds required for track rehabilitation work of large magnitude during the coming five or seven years.

The analysis of the traffic business of the company shows an average haul of 1¼ miles, thus confining the field of the surface railway to the short-haul business. From 1914 to 1919 the annual gross earnings of the company fell from $14,295,000 to $12,418,000, while the Interborough gross earnings, subway and elevated, during the same period increased from $34,128,000 to $43,814,000. While, since July 1, 1919, there has been a partial return of the surface line earnings, any further marked increase in surface line earnings is too problematical to count on with confidence. Headways are now close enough to get all the business available in the inner part of the system, and it is doubtful if any further business might be obtained in outlying sections from more frequent headways using safety cars.

The only relief possible to increase gross earnings, therefore, seems to be in an increase in fares. An analysis of the fare situation and the traffic on the road leads the engineers to the conclusion that the answer cannot be found in a 5-cent fare with a 1, 2, 3, or even 5-cent transfer charge, but that the most simple and effective way is to inaugurate a flat increase in rate with free transfers. The same analysis of the traffic leads the engineers to the conclusion that the surface lines are of no particular importance as feeders to the rapid transit system, but that the surface lines' usefulness will continue to be confined to the crosstown and short-haul business.

Service at Cost Recommended

The report calls the arrangement between the New York Railways and the Interborough Rapid Transit Company advantageous for the former. The surface lines, at a cost of one-fifth the total general management cost of the entire system, Interborough and surface combined, get the benefit of the service and judgment of an organization of great ability and experience. This applies as well to purchasing, maintenance of equipment, and power, and the cumulative effect of these factors is of undoubted advantage to the New York Railways. A detailed analysis of power rates and the relation from a power standpoint between the New York Railways and the Interborough Rapid Transit Company is given in the discussion of the report. It is of interest to note that for the year 1919 the power costs of the New York Railways were 3.38 cents per car-mile as compared with 5.40 cents per car-mile for the Philadelphia Rapid Transit Company.

Under the discussion of the franchise situation in New York, the engineers recommend that the New York Railways and the city work out a plan providing for a service-at-cost franchise. A short analysis of what is meant by this term is given and reference is made to other cities in which such a plan is in successful operation.

Financial News Notes

Valuation Commission Created.—The bill creating a commission to value the public utility properties in New Jersey and especially the Public Service Railway has been passed by the New Jersey Legislature. The commission, under whose direction the work will be carried out, consists of the Governor, State Comptroller and State Treasurer.

Receiver Discharged.—J. D. Whittemore was discharged as receiver for the West Virginia Traction & Electric Company, Wheeling, W. Va., on April 14. As announced in the ELECTRIC RAILWAY JOURNAL for April 10, page 772, the line will be transferred to the Wheeling Public Service Company, details of the capitalization of which were given at that time.

Will Seek Permission to Abandon Lines.—The Steubenville, East Liverpool & Beaver Valley Traction Company, East Liverpool, Ohio, notified the Mayors of East Liverpool, Wellsville and Steubenville on April 16 that it would apply on or about May 1 to the State Public Utilities Commission for permission to abandon three lines in East Liverpool, two in Steubenville and make changes in its service at Wellsville because of a loss of $167,513 last year. The company appeals for additional revenue. The present city fare is 5 cents.

Receiver for Road at Olean.—William A. Dusenbury, Olean, N. Y., has been appointed receiver for the Western New York & Pennsylvania Traction Company, Olean, by Justice Cole in the Supreme Court in Buffalo. The appointment was made on behalf of a judgment creditor. The action was not opposed by the company. Wilson R. Page resigned recently from the presidency of the company and the management and operation of the line were taken over by Day & Zimmerman, Philadelphia, Pa. Mr. Dusenbury will continue as receiver under bond of $100,000.

Three-Year Notes Sold by Milwaukee Company.—Spencer Trask & Company, New York, N. Y., are offering for subscription $2,000,000 of three-year 7 per cent secured gold notes of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., due on May 1, 1923. The offering price is 97⅞ and interest to yield full 8 per cent. Interest is payable on May 1 and Nov. 1. The notes, in addition to being a direct obligation of the company, will be secured by the pledge of $3,000,000 of general and refunding mortgage 5 per cent bonds, due in 1951. This is presumably a refunding operation as the company has $2,000,000 of two-year 7 per cent notes coming due on May 1.

Preferred Stock Dividend Passed.—The dividend on the preferred stock of the Nashville Railway & Light Company, Nashville, Tenn., payable ordinarily on April 1, 1920, was passed because of an action of the Public Utilities Commission of the State of Tennessee in connection with the application of the company for an increase in fare. This increase was granted on certain conditions, one of which was that "until such time as the commission shall establish rates on the permanent basis of the amount invested in the property of the company, and upon which it is entitled to a proper return," the company not pay dividends. The $274,000 of Nashville & Edgefield bonds due on Jan. 1 were paid at maturity. Refunding and extension bonds of a like amount were issued by the Nashville Railway & Light Company.

Call for Deposits.—A committee has asked the holders of the first mortgage 5 per cent bonds of the Ft. Wayne, Van Wert & Lima Traction Company, Springfield, Ohio, on which interest was defaulted on Jan. 1, 1920, to deposit their bonds, with all unpaid coupons, including that of Jan. 1, 1920, attached, with either the Fidelity Trust Company, Philadelphia, Pa., or the People's Savings & Trust Company, Pittsburgh, depositaries. The committee is composed of J. C. Neff, chairman, Fidelity Trust Company, Philadelphia; George K. Johnson, Penn Mutual Life Insurance Company, Philadelphia; George deB. Greene, and Thomas J. Walsh, E. H. Rollins & Sons, New York; A. C. Robinson, People's Savings & Trust Company, Pittsburgh, with T. H. Atherton, secretary, 325 Chestnut Street, Philadelphia, Pa. The company is included in the system of the Ohio Electric Railway, the operating management of which has passed to Day & Zimmerman, Philadelphia, under conditions outlined recently in the ELECTRIC RAILWAY JOURNAL.

Traffic and Transportation

St. Louis Fare Reduced

Commission Orders 7-Cent Flat Rate—Finds Return Under 8-Cent Fare Excessive

Declaring revenues resulting from an 8-cent cash fare to be excessive, the Missouri Public Service Commission on April 2 ordered the United Railways of St. Louis to reduce its rate to 7 cents straight. The company was directed to lower the rate for children from 4 cents to 3 cents. Improvements in the service were also specified. The commission's order became effective on April 10. The new rates are to continue operative until Jan. 1, 1921.

In reaching an estimate of the value of the company's property, the commission accepted two valuations, one of $50,000,000, and the other of $60,000,000, for the entire physical properties in St. Louis city and county. This was done in the absence of the true valuation of the property, which the commission announced will be completed by its engineers and accountants within a short time.

$950,000 Reduction

Basing its conclusions on figures submitted for the period from November to February, the commission decided that, under the existing fares, the United Railways would show an approximate return of 7.45 per cent for the entire year if the valuation were placed at $60,000,000, and 8.95 per cent if the $50,000,000 valuation were to be accepted.

This rate of return, the report states, would be excessive, and a reduction in fares was therefore authorized. The saving to the public by the reduction is estimated at $950,000 a year, according to J. L. Harrop, chief engineer for the commission.

The decision was made following an application of the receiver for an extension of the present fares for the ensuing year. Attorneys for the city, who opposed the extension, declared that the annual revenue of the company was more than 50 per cent greater than under the 5-cent fare, and that the revenue was increasing each month. Since Nov. 1, 1919, the fare has been 7 cents for tokens in quantities of fifty or more, 7½ cents when purchased in pairs from conductors, seven fares for 50 cents, and 8 cents for single fares. Children's fares have been two for 7 cents, or 4 cents for single fares.

More Trailers Ordered

The decision was reached by the unanimous vote of the entire commission, sitting in Jefferson City. The order directed the receiver for the company to place in operation fifty additional trailers. The company is permitted to furnish the extra cars at the rate of two a week.

According to the findings of the commission, the company is expected to transport 284,000,000 passengers in 1920. The number of passengers in November was 21,931,788; in December it rose to 22,984,394. The revenues for the two months were $1,606,585 and $1,683,258, respectively. For the same months in 1917, when the flat 5-cent fare was operative, the revenues were $1,063,446 for November and $1,088,440 for December.

Traffic Increase Shown

Increases in revenue and the number of passengers carried during January and February, 1920, corresponding to those shown in November and December, were shown. The commission based its estimate of the increasing number of passengers on the fact that more persons ride in the summer.

The new rates are effective from April 10 to Jan. 1, 1921, with the commission retaining jurisdiction to again fix the rates upon the definite appraisal of the company property.

The city has applied to the commission for a rehearing of its order, asking that the rate be further reduced to 6⅔ cents. In its motion for rehearing the city alleges that the commission's allowance of 6 per cent of the company's gross revenue for injury and damage reserve is excessive. The motion also objects to the setting aside annually of $1,500,000 for the depreciation reserve and claims that $900,000 would be adequate for this purpose.

Atlanta Company Wants 8-Cent Fare

A petition for increase in rates which the Georgia Railway & Power Company, Atlanta, Ga., has announced it will file with the Railroad Commission contemplates an advance of 33⅓ per cent in all classes of service, including gas, electric and railway service. In the case of gas the rate would be increased from $1.25 per 1,000 cubic feet to $1.66 per 1,000 cubic feet, the maximum rates subject to 10 per cent discount.

The maximum rate for electric service is now 8 cents per kilowatt hour. The new rate would be 10.6 per kilowatt hour. The increase proposed in railway fares would raise the fare from 6 cents to 8 cents.

The request for rate increases will be based on the increased cost of operation of the company, included in which is the recent award of a 15 per cent increase to motormen and conductors of the company. This increase was granted through arbitration.

Auto Deadline Does It

Anti-Parking Rules Reduce Congestion and Speed Up Railway Traffic in Los Angeles

Restrictions on the parking of vehicles within the congested district of Los Angeles, Cal., are having a marked effect in improving electric railway service in that city. Although the "no-parking" regulations have been in force for only two weeks, they have already accomplished results which, according to H. Z. Osborne, Jr., chief engineer of the city's public utilities department, fully justify their existence. The operation of cars has been speeded up by the cutting down of headway, and, for the first time in years, schedules are being maintained.

The so-called "no-parking" ordinance went into effect on April 10. Under it the city's business district is divided into three sections, a "congested" zone, a semi-restricted section, and an unrestricted area. Within the first of these, the parking of vehicles is prohibited between the hours of 11 a.m. and 6:15 p.m. Outside of this "congested" area, but still within the business district proper, is a zone within which automobiles may be parked for a period of two hours without police interference. Beyond the boundaries of this area, unrestricted parking is permitted. The use of the "left-hand turn" is also prohibited within the no-parking hours.

Drastic Measures Needed

The ordinance was passed by the City Council some time ago as a means of relieving a condition of congestion declared by competent observers to have few parallels in the United States. Drastic regulations to control the movement of vehicular traffic were recommended by the State Railroad Commission as offering the best hope of remedying the situation. The no-parking plan was described in detail in the ELECTRIC RAILWAY JOURNAL for March 20, page 623.

The speeding up of rush-hour traffic has been the most striking result of the enforcement of the new rules. Electric railway cars, both local and interurban, are moving through the city streets without delay. Schedules are being maintained without the interruptions which have been frequent in the past.

Car riders are arriving home in the evening from ten to fifteen minutes earlier than formerly. In the past it has been a common occurrence for cars to be delayed from forty minutes to one hour or more. These delays, which resulted from congestion in the business district, have been reduced to a minimum.

Pedestrian traffic, also, has been speeded up and has been placed on a basis of greater safety. At the busiest corner of the central district a check of persons crossing the street between the hours of 5 and 6 p.m. shows an increase in foot-travel of 30 per cent.

Washington Increase Granted

Commission Allows Eight-Cent Cash Fare on All Lines of District—Tax Readjustment Urged

Cash fares on all the electric railway lines of Washington, D. C., will advance from 7 cents to 8 cents on May 1 under the terms of an order issued on April 15 by the Public Utilities Commission of the District of Columbia. The increase affects the lines of the Washington Railway & Electric Company, the Capital Traction Company, the Washington-Virginia Railway, the East Washington Heights Traction Railroad and their subsidiaries. Four tickets will be sold for 30 cents. The 2-cent charge for inter-company transfers will continue, there being no charge for transfers between the lines of the same company. The new rates will remain in effect until Jan. 1, 1921.

THE commission based its order upon the application of the Washington Railway & Electric Company for relief beyond that afforded by the 7-cent cash fare with four tickets for 25 cents, which was put into effect Nov. 1, 1919. Early last January the company requested the commission to sanction a further increase in fare, stating that it could not long continue to operate at the 7-cent rate. At subsequent hearings William F. Ham, president of the road, testified that during the preceding twenty months the company had operated at a loss of more than $1,100,000.

$625,000 Estimated Increase

The new rate will, it is estimated by the commission, increase the company's revenue by $625,000 annually. This is less than the amount declared by the company to be necessary to assure a return of 6 per cent upon the investment. Under the new rates the return on the railway investment of the District taken as a whole will, it is believed, be slightly in excess of 7 per cent.

The Capital Traction Company had not applied for an increase, but the commission deemed it advisable to order a uniform rate for both roads. The two systems are highly competitive in the central section of the city, and the commission feared the demoralizing effect of a disparity in rates. Further adjustment of revenue to give both systems approximately the 6 per cent return declared by the commission to be just should, in that body's opinion, come from Congress in the shape of regulation of the tax rate. On this point the commission said:

> The commission is of the opinion that only a part of the relief asked for should be secured by an increase in rates of fare and that in fixing a rate the commission should assume that Congress will also grant relief through a modified form of taxation. . . .
>
> The commission is faced, therefore, with the necessity of granting an increase to both systems, but it believes that the Congress should readjust the method of taxation so that the Washington Railway & Electric Company will be relieved of a portion of its present tax burden. The revenues of the district thus diminished would be recouped by increasing the tax on the other system, and this increased tax would in turn offset the fare increase granted to that company solely to protect the public from the evil consequences of different rates of fare for the several companies.
>
> The proposed increased fare will under existing law unduly increase the revenues of the Capital Traction Company, but if the street railway lines of the District of Columbia be considered as a whole the new rate will yield a return only slightly in excess of 7 per cent on the combined fair value of all the street railway property used and useful for street railway purposes in the District of Columbia as heretofore determined by this commission.

A proposal to establish a zone-fare system was considered by the commission, but was rejected as impracticable under existing conditions. The order referred to the proposal as follows:

> At the request of the commission, the Washington Railway & Electric Company presented information through its expert, Prof. Albert S. Richey, of the application of a zone system to its lines. Decided opposition was manifested by individual citizens and by representatives of various civic bodies to the adoption of any form of measured service, and while the commission believes that it is right and just in principle that the users of a public service should pay for that service as far as possible in proportion to the cost of furnishing it to them, it is of the opinion that under present conditions it is inadvisable to adopt a zone system of street car fares or any other form of measured street railway service.

Wants Jitney Menace Removed

As a means of reducing the deficit in the operation of the Seattle (Wash.) Municipal Railway, Mayor Hugh M. Caldwell, in a communication to the City Council, asks for more stringent regulation of the jitneys. D. W. Henderson, general superintendent of railways, estimates that curtailment of the jitney competition would result in an additional revenue of approximately $200,000 annually for the railway. Mayor Caldwell wants the jitneys to operate on schedule and the equipment to be subject to city inspection. The operation of jitneys in Seattle began in 1915, when 1,500 buses entered the service. At present about 215 jitneys are operating in the city.

Mayor Caldwell urges that the Council consider first of all the fact that the municipal railway should be so operated as to pay expenses. He points out the injustice of permitting the jitneys to scoop up the cream of the business, leaving the railway to maintain its schedule throughout the day, regardless of whether or not it is profitable to do so. Mr. Caldwell concurs in the recommendation of the superintendent of railways that legislation should be passed by the city requiring the operators of jitney buses to:

(a) Secure a license to operate a motor bus (and this should include inspection with the right of suspension or revocation).

(b) To operate according to schedule between the terminals of route applied for and at fixed rates of fare.

(c) All vehicles used in motor bus service to be subject to inspection as to equipment.

Mayor Caldwell also submitted a report of E. A. Mitchell, transportation inspector, declaring that city lines can take care of 40 per cent more business than is now being carried. Mr. Mitchell, in his report, calls attention to the unfair methods used by jitney drivers to secure business.

A report submitted by the weights and measures division indicates that the personnel of the jitney organization is far from satisfactory and is not subject to proper supervision.

The utilities committee of the Council has asked W. F. Meier, Corporation Counsel, to prepare an ordinance providing for the regulation of the jitneys.

Local Regulation Proposed

People of St. Paul Will Vote on May 4 on Putting Fare Control in Hands of Council

At the general city election on May 4, the people of St. Paul, Minn., will vote upon a proposed amendment to the charter of the St. Paul City Railway authorizing the City Council to regulate the fares to be charged by the company, providing, however, a maximum of 7 cents with free transfer. The ordinance has been passed by the City Council and accepted by the company. It now awaits action by the people. The original ordinance was approved on Sept. 20, 1889. It has nineteen years to run.

It is prescribed in the amendment that in no event shall the company be entitled to more than the present 5-cent fare until it shall have built and put in service sufficient cars, or is furnishing car service as prescribed by the city ordinance. The company is specifically relieved from any 5 per cent gross earnings tax because such a tax tends to increase the fares. The company does not now pay any such gross earnings tax.

While some doubt exists in the minds of city officials as to whether this ordinance will be approved at the election there is still pending in the Federal Court a suit brought by the company to restrain the city from enforcing the service feature of the ordinance now in force. The injunction is in the form of a temporary restraining order. The hearing as to whether this shall be made permanent may be called at any time.

The ordinance will in effect do four things if approved:

> It will grant to the City Council the power to regulate and fix fares.
>
> It will prohibit the Council from ever fixing the rate higher than 7 cents, but will not establish a minimum.
>
> It will prohibit the company from ever receiving any increase unless and until it provides cars sufficient to furnish the service prescribed by the city ordinances.
>
> It will place the company under all restrictions and regulations contained in the city charter relating to public utilities, excepting only that it will specifically exempt the company from paying the gross earnings tax.

The controversy over service by the railway originated two years ago. The company pleaded that it was operating at a loss and asked relief from the Council in the way of larger fares than those prescribed in the ordinance. The Council had this under consideration for a long time and in 1918 made an audit of the company's books through

a certified accountant. The result indicated that the company was operating at a loss, the finding based on the understanding that the figures it furnished the city were correct. In August, 1919, F. L. Powers succeeded Commissioner Oscar Keller in charge of public utilities and he took an immediate interest in the question.

Mr. Powers had another examination made, by the chief accountant of the department, and, excepting an amount set aside by the company for depreciation, a matter upon which authorities might disagree, it was found that the company was operated at a loss in 1919. After the cost-of-service franchise failed of approval at a special election last fall in Minneapolis the plan was proposed to the St. Paul company that the city regulate the fares, the advance and decline to be left to the judgment of the Council. This amendment to the ordinance was prepared by Commissioner Powers and submitted to the company. In due time the company filed its acceptance of the ordinance. The matter will now go before the people.

City's Appeal Denied

New York Commission Rules Rochester Lines Are Fulfilling Requirements Under Present Conditions

The application made by the city of Rochester to the Public Service Commission for the Second District of New York for an order directing the New York State Railways to increase the railway service in Rochester was denied on April 16. In the opinion the commission said:

> It appearing from the evidence that orders heretofore made by this commission with regard to equipment and service in the city of Rochester have not been disobeyed by said railway company, except for a short period during a time of emergency; and that the revenues of the company are not sufficient to enable said company to furnish adequate, sufficient and proper service within the city of Rochester, and the commission being of the opinion that under the facts disclosed in the record, the making of an order requiring the large additions to service which are found to be necessary would be an arbitrary and unreasonable exercise of the power possessed by it under subdivision 2 of section 49 of the Public Service Commission's law

In consequence the commission ruled that the order to show cause in the case be discharged and the case closed on the books of the commission.

Commissioner Barhite wrote the prevailing opinion. He is sustained by Chairman Hill and Commissioner Irvin. Commissioner Kellogg dissented. Commissioner Van Namee, recently appointed, was excused from voting. In dissenting, Commissioner Kellogg favored the issuing of an order directing the respondent to furnish service "which shall be adequate as required by sections 26 and 49, subdivision 2, of the Public Service Commission law."

Commissioner Barhite found that the railway obeyed the commission's order to reroute the Monroe Avenue line and also to increase its service in non-rush hours up to Jan. 16 last, which sickness of employees and severe weather prevented. Commissioner Barhite also recited that the company set up the claim that the commission had no authority in law to confiscate its property. This is what the company alleged would be brought about by an order to increase service with an increase in fare.

The law of New York State provides that where the Public Service Commission fixes rates it shall have due regard among other things to a reasonable average return upon the value of the property actually used in the public service and to the necessity of making reservations out of income for surplus and contingencies. Mr. Barhite said:

> If it be contended that if a rate when fixed is fair and reasonable, that such rate is fair for all the time does not follow. While it is true that these cases deal with rates of fare as fixed by statute, as distinguished from the Rochester contract, it cannot be said that the distinction takes away from the company the protection of the Constitution, which is the supreme authority in the land. Even if it be urged that the State Constitution, Article III, section 18, takes away the protection guaranteed by the United States Constitution, then the only result would be that that particular section of the State Constitution, to which reference is made, is itself unconstitutional.

Mr. Barhite finds that in view of the legal right which the New York State Railways has to demand a proper compensation for its services, the commission might make some "other" order with regard to service if it appears that its present rate of fare will not furnish such service.

The commissioner refers to the record showing the deficit for operation in 1919 in the 5-cent zone in Rochester, which was $643,171, and on the suburban lines $80,443, and that no estimated deficit for a future twelve-month period with an increased proper service in the 5-cent zone would amount to $835,974. He asks, therefore, whether the present fare in Rochester is just and reasonable for the company. In this connection the commissioner said:

> It is evident from the authorities to which attention has been called, that the New York State Railways has an absolute right to an income which will pay not alone its necessary expenses of operation, and its proper fixed charges, but will produce a fund sufficient to provide a surplus for contingencies and a proper and reasonable return upon the value of the property used in its business. It is further apparent that if the present rate fixed by the contract is not sufficient to furnish the amount of money necessary to provide for the purposes to which attention has been called, the State cannot, and if it can should not attempt to force the company to perform services beyond its power.

City Has Power Over Rates

Four of the five judges of the Appellate Division of the Supreme Court of Ontario have ruled in a suit respecting the London Street Railway that the city of London has power to alter a contract covering fares incorporated in a franchise agreement, without a vote of the citizens or the consent of the provincial Legislature or the Hydro Electric Power Commission of Ontario. The City Council to end a strike last July passed a municipal by-law permitting an increase in fares from seven and nine tickets for a quarter to six and eight tickets. A judge of the Supreme Court quashed the by-law and restored the old rates. The corporation counsel had given his opinion that the Council of an Ontario municipality was debarred from altering a franchise agreement by provincial legislation.

The street railway company's legal advisers obtained the Council's permission to appeal in the name of the city of London and established the City Council's rights and the by-law's validity, only one of the five Appellate Division judges dissenting.

The platform men of the London Street Railway at present receive a maximum rate of 44 cents an hour. They now want 65 cents an hour. This demand the company has announced it is unable to satisfy and another strike is threatened for May 1.

Orders City to Cease Bus Operation

Operation of buses under the direction of Grover A. Whalen as Commissioner of Plant and Structures of New York City is in violation of the law, according to a ruling made recently by Justice Cropsey of the Supreme Court. The Justice ordered a suspension of the bus service. Justice Cropsey held that there had been no emergency which justified the operation of the buses. He said that the operation of the buses was a flagrant violation of the law and held that the city had no more right to violate the law than any citizen. The suit was brought by the Brooklyn City Railroad against Mr. Whalen individually and as commissioner. On application of counsel for the city, the Appellate Division of the Supreme Court has granted a temporary stay of Justice Cropsey's order until April 29.

Justice Edward J. Gavegan of the New York Supreme Court on April 9 signed an order directing the city to show cause why a temporary injunction should not be issued suspending operation of all bus routes competing with the surface lines of the New York Railways. Job E. Hedges, receiver for the traction company, had previously obtained from Federal Judge Julius M. Mayer an order directing him to bring suit to have the operation of the buses halted.

The State Senate on April 20 passed a bill which, if it becomes law, will give the city of New York power to operate bus lines. The measure, the passage of which was urged by Commissioner Whalen, would legalize the purchase and maintenance of motor buses by the city. As originally introduced by Senator Lynch, it authorized the establishment of bus routes in competition with electric railway lines. The bill was later amended to prohibit said competition, and in amended form was passed by the Senate. It is now under consideration by the Assembly, which is expected to take favorable action on the measure.

Transportation News Notes

Fares Up on Municipal Line.—The board of directors of the municipally owned Norton, Taunton & Attleboro Street Railway, Attleboro, Mass., has voted to increase the single fare from 7 cents to 10 cents, the increase to become effective at once. A ticket good for fourteen rides will be sold for $1.

Wants More in Knoxville.—The Knoxville Railway & Light Company, Knoxville, Tenn., has applied to the State Railroad & Public Utilities Commission for permission to charge a 7-cent fare with 2 cents for each transfer. In its petition, the company states that it operated at a loss of $25,000 in 1919.

Seven Cents in Attleboro.—Fares on the lines of the Interstate Consolidated Street Railway, Attleboro, Mass., were raised from 6 cents to 7 cents on April 18 under a temporary order of the Massachusetts Department of Public Utilities. The department will hold a hearing on May 5 for the purpose of fixing a permanent rate.

Zone Changes in Worcester.—The Worcester (Mass.) Consolidated Street Railway has made several changes in the zone limits on its lines in Worcester at the direction of the Massachusetts Department of Public Utilities. The latter, which has had the company's case under consideration, has intimated that it will order the retention of the two-zone system with a 7-cent fare in each zone, as at present.

Side and Terminal Service Discontinued.—The transportation of mails by the Kansas City (Mo.) Railways between the Kansas City postal substations and the Union Station has been discontinued. The mail cars have been replaced by forty-three motor trucks. The increase in mail, especially in parcel post matter, owing to many new mail order houses being opened in Kansas City, made the change imperative.

Raises Commutation Rates.—Commutation rates on the lines of the Washington-Virginia Railway, Washington, D. C., were raised on April 16 under authority granted by Interstate Commerce Commission. The price of twenty-trip tickets, good for a period of two weeks, was increased from $2.70 to $4, an advance of $1.30 on each ticket. Last December the price of monthly commutation tickets was raised from $4.05 to $4.45.

Municipal Line Increases Fares.—The St. Thomas (Ont.) Municipal Railway has increased fares from eight for a quarter to six for a quarter to cover the extra cost of wage advances. The old wage rate of 40 to 45 cents an hour has been increased 5 cents. Fares of 5 cents, 6 cents, 7 cents and 10 cents on different lines of the Peterboro (Ont.) Street Railway (Hydro Electric Power Commission) will be adopted at an early date to cover increased operating costs and the costs of extensions.

Upholds Michigan Rate Law.—The constitutionality of the State law granting to roads earning less than $8,000 a mile the right to charge fares of 2½ cents a mile on their interurban lines was upheld in an opinion recently handed down by the Michigan Supreme Court. The court reaffirmed its finding in another case that the State, through its Legislature, has the right to set aside franchise agreements between public service corporations and municipalities.

Ten Cents on Hudson Tubes.—The Hudson & Manhattan Railroad, New York, N. Y., raised its rates on April 19, when it resumed operations after the strike of its trainmen. The company, which operates the Hudson River tubes, now charges a 6-cent fare from New Jersey to the Hudson Terminal, Manhattan, and a 10-cent fare to uptown New York. The rates were formerly 5 and 7 cents, respectively. The Interstate Commerce Commission has refused to suspend the new rates.

Would Retain 6-Cent Fare.—The Winnipeg (Man.) Electric Railway has applied to the Public Utilities Commission of Manitoba for a permanent increase in fare to 6 cents. The commission several months ago allowed the company to install a 6-cent fare temporarily. At a recent hearing on the company's application witnesses testified that the average cost per passenger in order to cover all operating costs and provide a return of 6 per cent on the investment was 6.14 cents.

One-Man Cars Approved.—Speeding up of service and reduction in costs through one-man car operation on its lines in Elgin are advocated as a partial solution of the financial difficulties of the Aurora, Elgin & Chicago Railroad, Aurora, Ill., by Joseph K. Choate, receiver of the company. Mr. Choate has submitted to the State Public Utilities Commission a report in which he recommends the use of safety cars and other changes in the road's equipment. Twenty-one "safeties" would be required to give adequate service in Elgin.

Will Reopen Staten Island Lines.—Federal Judge Chatfield has authorized the city of New York to enter into an agreement with Jacob Brenner, receiver for the Staten Island Midland Railway, Richmond Borough, for the operation of the company's lines. The company suspended service on Jan. 16 last, after futile efforts to secure financial relief from the city. All attempts on the part of the city to force the road to resume operation have failed. Judge Chatfield on April 9 authorized the city and the receiver to unite in working out a plan for the resumption of service. Cars will be leased by the city from the company.

Reject Higher-Fare Proposal.—A proposition to allow the Michigan Railway, Kalamazoo, Mich., to charge a 7-cent fare on its lines in Kalamazoo was defeated by the voters of that city at a special election on April 5. The City Council had previously agreed to waive the 5-cent fare provision of the company's franchise provided such a course were approved by the voters. Although the proposition received a majority of 78 votes at the polls, City Attorney Shaberg ruled that the city charter and the State Constitution required a two-thirds vote to carry the proposal. The company will appeal the case to the courts.

Tokens for Toledo.—The Toledo Railways & Light Company, Toledo, Ohio, will use metal tokens on its lines beginning about May 1. The present scale of fares, set by the Federal Court at 7 cents, with three tickets for 20 cents, made necessary the issuance of paper tickets, the first used in more than three years. Fare boxes installed this year necessitate the use of tokens. The court ruled that passengers may ride for 6 cents cash if the conductor cannot furnish tickets. Bus fare in Toledo, set at 10 cents with 25-cent owl service during the transportation tie-up, dropped to 5 cents on most lines as soon as cars began operating at the 7-cent fare.

Penalty for Non-Payment.—The New Jersey Legislature has passed a law which places electric railways on the same basis as steam roads in the matter of protection in the collection of fares. The measure provides that "Any person who shall travel on any street railway car without having paid his fare, and with intent to avoid payment thereof, or any person who, having paid his fare, and having traveled on such car to a point where, under the rule of the company operating such car, as announced by the conductor of said car, an additional fare is due, shall on demand refuse or fail to pay such additional fare or leave such car, shall be deemed and adjudged to be a disorderly person." The act has already gone into effect.

Seven-Cent Fare in Mobile.—A 7-cent fare became effective April 14 on the lines of the Mobile Light & Railroad Company, Mobile, Ala. The City Commission on April 6 voted unanimously to allow the company to raise the rate from 5 cents to 7 cents for a period of two years. The company was directed to sell four tickets for 25 cents and five for 30 cents. The skip-stop is to be abandoned within sixty days. An audit of the company's books showed that the company earned approximately $87,000 between October, 1918, and October, 1919. Later a second audit was made covering the years between 1912 and 1918 which showed that the company had made a net annual earning during this period of more than $100,000, or a total of $670,000 in the six-year period. This amounted to a return of 4.97 per cent on the investment.

Personal Mention

A. L. Kempster Goes South

Appointed General Manager of New Orleans Railway Company, Succeeding John S. Bleecker

A. L. Kempster, manager of the Seattle division of the Puget Sound Traction, Light & Power Company until the railway property in that city was acquired by the city of Seattle a year ago, has been appointed general manager of the New Orleans Railway & Light Company, New Orleans, La. Mr. Kempster succeeds John S. Bleecker, whose resignation as general manager of the New Orleans system was announced in last week's issue.



A. L. KEMPSTER

By virtue of his present appointment Mr. Kempster becomes the operating head of one of the most important public utilities of the South. The New Orleans Railway & Light Company, a subsidiary of the American Cities Company, operates 218 miles of track. The property is now in the hands of J. D. O'Keefe, receiver, for whom Mr. Kempster will direct the system.

Since leaving Seattle Mr. Kempster has been engaged in the conduct of investigations into public utilities for Stone & Webster. The survey of the lines of the Brooklyn Rapid Transit Company and the New York Railways, recently completed, was made largely under his direction. For several months he assisted Frederick P. Royce, then general manager for the receiver of the Brooklyn Rapid Transit Company, and later took part in the appraisal of the Manhattan surface lines.

Mr. Kempster was born in Canfield, Ill., in 1872. Entering the employ of the Seattle Consolidated Railway as a clerk at the age of nineteen, he was subsequently made bookkeeper and auditor.

When the Seattle Consolidated Railway was reorganized as the Seattle Traction Company, he became secretary and auditor, continuing in these capacities until the merger of the city's utilities under the name of the Seattle Electric Company. Entering the operating department at that time, he was made trainmaster of the system.

In 1902 he was advanced to the position of superintendent of transportation, retaining this title for eight years. He was then appointed superintendent of the railway department. Still later he was again promoted, becoming general manager of the Seattle properties. He served in this capacity until early in 1919, when the system was taken over by the city.

Alexander Shapiro, formerly statistician for the American Electric Railway Association, has become connected with the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., as a member of its statistical staff.

Alfred D. Blake, superintendent of the Derby division of the Connecticut Company, New Haven, Conn., has been appointed superintendent of transportation of the lines formerly included within the system of the Shore Line Electric Railway, Norwich, Conn. These lines recently reverted to the Connecticut Company under a court order.

H. B. Flowers, general manager of the United Railways & Electric Company, Baltimore, Md., was elected second vice-president of the company at the annual meeting on April 14. Mr. Flowers will continue to discharge the functions of general manager. He assumed that office several months ago. A biography of Mr. Flowers was published in the ELECTRIC RAILWAY JOURNAL at that time.

Arthur H. Mann, resident engineer of the Empresas Electricas Asociadas, operating the city and suburban railways at Lima, Peru, South America, expects to sail for Lima from New York on April 28. For several years Mr. Mann was electrical engineer for the city railway in Evansville, Ind., and the Evansville & Princeton Traction Company. Later he was division manager of the city and suburban lines of the Michigan United Railways at Lansing, Mich. Before going to South America five years ago he was general superintendent of the Jersey Central Traction Company and the Middlesex & Monmouth Electric, Heat & Power Company at Keyport, N. J. During the world war the company was unable to get cars and other equipment from the United States or any other foreign country and Mr. Mann made several cars in Lima that are all American in style.

Mr. McCauley at St. John

Manager of Municipal System Appointed to Important Post with Private Enterprise

Thomas H. McCauley, formerly superintendent of the Calgary (Alta.) Municipal Railway, has assumed the duties of general manager of the New Brunswick Power Company, St. John, N B. The system of which he is now in charge includes railway, power and light properties serving a community of more than 40,000 persons.

Mr. McCauley's management of the Calgary Municipal Railway was attended by marked success both from an operating and an engineering standpoint. This is indicated by the fact that, when the city contained between 65,000 and 70,000 persons, the railway carried in the neighborhood of 45,000 riders daily. These results were accomplished largely through a liberal ticket policy. In 1918 it was estimated that the proportion of riders carried on tickets was at least 80 per cent.



T. H. McCAULEY

Realization of the possibilities contained in the one-man car was largely responsible for Mr. McCauley's success at Calgary. He early conceived the idea of rebuilding two-man cars of the older types to require the services of only one operator. As a result, the wages per car-mile to motormen and conductors decreased from 7.641 cents in 1913 to 5.688 cents in 1918, and in the interim wages had been largely increased.

Mr. McCauley has had a varied career as a utility operator. He was born in Peel County, Ont., in 1872. Entering the employ of the Bell Telephone Company at Port Arthur in 1889, he served as a lineman until 1891, when he was made local manager for Port Arthur and Fort William. Three years later he was made superintendent of the Port Arthur Street Railway & Electric Light Company. In 1909 he was appointed general superintendent of construction of the Calgary Municipal Railway. Upon the completion of the line he became superintendent, continuing in that capacity until his appointment at St. John.

New Manager for Doherty Interurban

J. Franklin Johnson has been appointed general manager of the Toledo & Western Railroad. With the appointment came the announcement that the general offices of the company would be moved from Toledo to Sylvania, Ohio, where the operating offices are located. The road operates between Toledo and Pioneer, Ohio, with a branch to Adrian, Mich.

A. P. Nicolet has been appointed secretary-treasurer, auditor and purchasing agent of the company, with offices at Sylvania.

Frank Coates, president of the Toledo Railways & Light Company, has been acting as general manager of the railroad for several years. Albert Swartz, also of the staff of the Toledo Railways & Light Company, resigns as vice-president of the Toledo & Western.

Mr. Johnson, the new manager, is a product of the Doherty training system. He joined the "cadet school" at Toledo, in February, 1916, after graduating from the University of Wisconsin as an electrical engineer. From Toledo he went to Durham, N. C., and later was transferred to Bartlesville, Okla. He comes to the Toledo & Western directly from the railroad department of Henry L. Doherty & Company, at New York.

The Toledo & Western has been in a difficult financial position for the last few years due to the increasing costs of operation and the decrease of revenues largely caused by good roads and automobile competition. The Adrian branch passenger business has been paying, but all other portions of the lines have been operated at a loss during the last year.

President Frank Coates and members of his staff have been attempting to put the road on a paying basis by acquainting the several communities served by it with the actual financial difficulties of present-day operation. They have held meetings at Morenci, Fayette and some other points on the railroad and have been promised co-operation by the people along the route.

It is expected that the establishment of the offices at Sylvania will bring the administration more directly in contact with the problems of the system.

A. B. Cole, general passanger and freight agent of the Monongahela Valley Traction Company, Fairmont, W. Va., has tendered his resignation. Mr. Cole has not yet announced his plans for the future.

J. O. Weigel has resigned as general superintendent of the International Railway, Buffalo, N. Y. Mr. Weigel succeeded Nelson H. Brown at Buffalo three years ago. He has not announced his plans for the future.

W. M. Casey, former superintendent of transportation of the Denver (Col.) Tramway, has been appointed general superintendent of the International Railway, Buffalo, N. Y., to succeed J. O. Weigel, resigned.

Thomas W. Connette, superintendent of transportation of the International Railway, Buffalo, N. Y., has resigned. He is the son of Edward G. Connette, former president of the company. Thomas W. Connette has gone into business for himself, organizing the Railway & Industrial Service Corporation.

Reuben B. Ladd has been made chief inspector of lines of the Connecticut Company, New Haven, Conn., formerly included within the system of the Shore Line Electric Railway. These lines have reverted to the Connecticut Company as the result of the abrogation of the lease under which they were operated by the Shore Line.

W. H. Smaw has resigned as purchasing agent of the Georgia Railway & Power Company, Atlanta, Ga., to accept the position as southern sales representative of the Electric Service Supplies Company, Philadelphia, Pa. Mr. Smaw had a very wide knowledge of the needs of the industry of which he was a part and established an enviable reputation in the work which he did for the company at Atlanta. He was born in Atlanta on Aug. 11, 1873, and was educated in the public schools of that city. He entered business with a large wholesale house and served successively as shipping clerk, assistant cashier, and traffic manager. He resigned this position in January, 1903, to become connected with the purchasing department of the Georgia Railway & Power Company. For two years prior to 1910 he acted intermittently as purchasing agent owing to the ill health of G. B. Graves, who then occupied that position. He succeeded Mr. Graves in December, 1910. Mr. Smaw has contributed occasionally to the ELECTRIC RAILWAY JOURNAL. Actively interested himself in the affairs of the American Electric Railway Association, Mr. Smaw has long urged more active participation in the work of the association by the purchasing agents of the industry as a group.

Obituary

Colonel John N. Partridge, formerly Police Commissioner of New York City, died at South Norwalk, Conn., on April 8. He was 83 years of age. Colonel Partridge was born in Massachusetts. He enlisted in the army in 1861 and fought through the Civil War. After the war he moved to Brooklyn, where he joined the old Twenty-Third Regiment, National Guard. In 1880 he became colonel of the regiment. From 1886 to 1897 Colonel Partridge was president of the Brooklyn City & Newtown Railway, afterward included in the system of the Coney Island & Brooklyn Railroad, which is now a part of the Brooklyn Rapid Transit System.

New Publications

Inventions, Their Development, Purchase and Sale.

By William W. Baff, patent attorney. 230 pages. D. Van Nostrand Company. New York City.

This is a practical manual for the inventor, prepared with the aim of assisting in the commercialization of inventions. A few of the twenty-four chapter headings will give an idea of the scope and contents of the book, as follows: Value and price of patents, types of inventions from the commercial side, developing inventions, patents as property, methods of making sales, elementary contract law, mistakes of inventors, etc.

Armature Winding and Motor Repair

By Daniel H. Braymer, A.B., E.E. 514 pages. McGraw-Hill Company, Inc., New York. Price $3.

This book discusses the subject of armature winding, repair shop methods and testing of armatures from a practical standpoint and no attempt has been made to include theoretical calculations. It is a compilation of practical methods that are used by repairmen and armature winders and includes details of those methods which have been found by actual experience to represent the best practice in a repair shop of average size. A handbook of useful information is thus provided which can be readily understood by practical men engaged in shop work.

Effective House Organs

By Robert E. Ramsay. D. Appleton & Company, New York, N. Y. 361 pages, 5 x 7½ in. Price, $3.50.

Mr. Ramsay has written a very readable book. It should appeal to all the men in the public utility field and in manufacturing who have to do with the conduct of house organs and should also be of considerable interest to the executives in public utility work who are charged with the responsibility of fostering better public relations. Mr. Ramsay's book is all inclusive, so that only a small part of it treats of public utility publications. House organ costs are given in detail. There are also valuable hints on typographical display. There are some public utility publications which are very attractively dressed typographically, but others could be considerably improved. Editors can find valuable hints along these lines in what Mr. Ramsay has written. The first part of the book sets forth the principles and practical methods for successfully conducting house organs. The second part presents the "how and why" of such publications. Of particular interest to all public utility publicity men is the chapter "How Public Service Companies Have Used House Organs Successfully."

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

N. O. T. Orders 111 New Cars

Three Types of Cars Costing a Total of Almost $1,500,000 Placed with J. G. Brill Company

Northern Ohio Traction & Light Company, Akron, Ohio, has placed an order with the J. G. Brill Company, Philadelphia, Pa., for 111 cars. The order is reported to include twenty interurban cars at $22,000 each, fifty-six Peter Witt cars at $13,500 each, twenty-five safety cars at $6,500 each and ten trailers at $7,000 each, making a total of $1,428,500.

Twenty-five of the large cars and ten trailers are expected to be placed in the Akron city service. Service on the Akron-Kent-Ravenna, the Canton-Massillon and the Springfield Lake divisions also will be improved, according to reports. The safety cars will be similar to those now being operated in Canton. The interurbans are said to seat fifty-eight persons, the Peter Witt cars fifty-four, the safety cars thirty-five and the trailers fifty-eight.

It is believed that a considerable number of the cars will be built in the G. C. Kuhlman Car Company's plant at Cleveland, Ohio. This is one of the four Brill plants.

Delivery on all of the equipment is expected to be made in the fall.

Window-Glass Scarce

Some Leading Interests Have Withdrawn from Market—Longer Production Schedules Planned

Car window glass stocks are low and car builders are having great difficulty in obtaining enough stock for present needs. The present railroad tie-up has interfered with shipments principally of raw materials billed to the glass factories and has caused a material curtailment in production.

Several leading interests have withdrawn from the market entirely and some had to close their books more than two months ago. One company expects to be in a position to open its books for orders in about three weeks to a month.

It is impossible to obtain polished plate glass in sizes that are used for car windows and railways must be content with heavier glass in from 32 to 39-ounce sizes.

Window glass manufacturers are operating in two periods on account of difficulty in securing skilled labor. About half the manufacturers who were supplied with coal and other materials have been running since about Dec. 10, 1919, and will continue until early in June. The factories operating at a later period will commence in August and will probably operate up to Dec. 1, unless by special agreement with the men they can be influenced to continue working beyond that date provided the need for glass is pressing at that time.

Electrification in South America

$2,000,000 Contract Placed with International G. E. for Locomotives, Line Material and Substation

Electrification of the Paulista Railway between Jundiahy and Campinas, Brazil, has been assured by the placing of a contract amounting to almost $2,000,000 with the International General Electric Company.

Equipment to be supplied consists of twelve locomotives, eight freight and four passenger engines and material for the transmission line, substation and 3,000-volt overhead. The locomotives will be built at the Erie Works of the General Electric Company.

The project anticipates further extentions amounting to 100 additional miles of route, which may eventually bring the total electrification up to 128 miles extending between Jundiahy and San Carlos. The new line is expected to be in operation by July, 1921. It is one of the largest railway contracts awarded since the Chicago, Milwaukee & St. Paul electrification. An elevation drawing of the freight, low motive and friction technical details of its construction will be found on page 855 of this issue.

Railway Signal Business Outlook Better

Deliveries Range from Several Days to Three Weeks—Prices $550 to $600 per Block—Sales Show Improvement for First Quarter

Although nothing like a boom in electric railway signal orders characterizes today's business, inquiries among representative manufacturers show that the outlook is improving for larger sales. One concern reports 15 per cent larger sales in equipment during the first quarter of 1920, as compared with the corresponding period last year, and another active competitor declares that while his sales are not much above those of 1919, a healthier tone can be noted in the market. Inquiries are coming in at a faster rate and maintenance orders are helping to keep this branch of the industry occupied. The total volume of business is still far below the productive capacity of the various plants engaged in manufacturing and the prospects of getting upon a "mass production" basis are remote at present. The type of signal apparatus used in standard makes is favorable to large scale production, the most important obstacle to this being the slowness of many operating companies to realize the value of the insurance afforded by the latest designs of equipment.

It is true that the cost of signal apparatus has increased since 1914 about 60 to 70 per cent and that the factory price of higher grade equipment is today of the order of $550 to $600 per block. The cost of accidents, however, expressed merely in money, is relatively greater than before the war, and the demands of the public for service are capitalizable as probably never before. It is a fair statement that the cost of signal installations will be met by the traveling public if the issue is made clear by the operating companies.

In one factory shipment of complete blocks can be made within two or three days, assuming an order for ten or a dozen sets. Another manufacturer would probably require three to four weeks on account of a local shortage of materials. Stocks of glass, wire and brass are reported in good shape, but steel parts and malleable iron castings are very hard to obtain. Labor conditions in the foundries are very unsatisfactory, wages being so high that many employees work only part time each week. The labor turn-over is also heavy. It is doubtful if malleable iron castings ordered in eastern New England today, for example, would be delivered before August 1, and the lack of such supplies, accentuated by the recent railroad strike and embargoes, is holding back some shipments of completed signal apparatus. At 35 cents per pound, some malleable castings exceed the cost of copper.

Price tendencies have been upward in view of recent labor advances, 10 per cent in a representative case a few weeks ago. One maker advanced his prices about 10 per cent in March, and another is uncertain as to his ability to maintain present quotations. No immediate advance appears in contemplation, and if the volume of business should increase it might be possible to

go no higher than present figures this summer. Equipment is becoming well standardized as a result of development work now practically completed. Some manufacturing interests are making a modest profit after several lean years, and as a whole the outlook is for gradually improving conditions predicated upon the recognition by the public that the cost of safe service must be met out of revenue.

Shipments Lengthen on Copper Products

Lack of Raw Materials and Coal Causing Hardships—Stocks Are Piling Up

In the face of a heavier buying movement than heretofore on the part of the railways which have commenced rehabilitation of rolling stock and equipment, and which have recently made large purchases of new equipment, the copper and brass mills are having their own troubles filling their orders. Several mills in the New England and New York territories are in whole or in part shut down because of labor troubles and shortage of raw materials and coal, while many mills which are running have only enough operatives to run one shift, with sufficient work on hand to run night shifts, too. One mill in particular is working four nights a week at full capacity until 9 o'clock and has not enough labor available to run a regular night shift. Productive capacity is in general booked up to a heavy excess.

Motor Trucks to Relieve Transportation Difficulties

Shipments are long. If transportation were available now, the mills, of course, could begin moving much of the material that is piling up in their warehouses. Motor trucks are moving quantities of it, but this method is merely taking the edge off the stocks piling up and is taking care of only rather local traffic. The mills that are running are quoting from six to twelve weeks for shipments, while at least one of those shut down is not quoting any shipping date. Copper sheets and brass shapes are in a condition somewhat analogous to that of the steel industry. Hot copper sheets are in heavy demand and are carrying a six weeks' shipping date. Cold-rolled copper sheets can be turned out in about double the time.

There does not seem to be any immediate prospect of relief for the situation outside of a resumption of rail traffic. This, of course, will release pent-up finished stocks, but it will in no wise increase the supply of labor which is necessary if more business is to be handled. Except in finished products, it is reported that little or no brass is being exported, the New England mills supplying domestic trade only. The electrical industry is taking more and more copper and brass tube, rod, wire and sheet, and it is expected that mill conditions and shipments will become increasingly more unsatisfactory as the summer advances. In connection with the export trade there is reported a heavy demand from India for sheet copper and brass.

Little Fluctuation in Copper Prices

Prices of finished and semi-finished materials have held quite steady for several weeks. Copper itself has been holding within a cent of 19 cents all this year and so has had little effect in changing prices of its products. The price of copper is not likely to advance materially unless a heavy foreign buying movement sets in. It would not be surprising, however, to see a slight advance in the raw metal when domestic buying for the third quarter opens up. This would probably be reflected in higher prices of copper and brass products. At any rate, production costs, in particular in the mills where strikes are on if labor obtains an increase, are liable to have a greater effect in increasing prices of brass and copper products than advances in raw materials. Prices have been withdrawn where strikes are holding up production because of the uncertainty of future producing costs.

Rolling Stock

Cumberland County Power & Light Company, Portland, Me, has purchased three snow-plows and one snow-sweeper.

Cloyd M. Chapman has resigned from Westinghouse Church Kerr & Company, Inc., and has opened an office at 171 Madison Avenue for the practice of consulting engineering.

Combustion Engineering Corporation, New York, N. Y., announces with regret the resignation of its vice-president in charge of sales, E. P. Moritz, on account of ill health. No successor to Mr. Moritz has been named.

Paulista Railway, Campinas, Brazil, has placed an order with the International General Electric Company for twelve electric locomotives. The eight freight locomotives will weigh 100 tons each and the four passenger type 120 tons each.

Public Service Railway, Newark, N. J., has purchased 100 trailers from the Osgood-Bradley Car Company similar to the type now in use at Cleveland, Ohio. Delivery will be made commencing in September and will be completed by December.

Northern Ohio Traction & Light Company, Akron, Ohio, has placed an order for 111 cars with the J. G. Brill Company. The order includes fifty-six Peter Witt cars, twenty interurbans, twenty-five safeties and ten trailers. Delivery will be made in the fall.

Pittsburgh (Pa.) Railways, noted in the Feb. 7 issue of the ELECTRIC RAILWAY JOURNAL as considering the purchase of a large number of cars, through its receivers, have asked the United States Court for permission to purchase 150 cars to cost approximately $2,000,000.

Track and Roadway

Los Angeles (Cal.) Railway.—It is proposed to extend the Western Avenue, Heliotrope Drive and Temple Street lines of the Los Angeles Railway.

Los Angeles, Cal.—The Los Angeles City Council has ordered that bids be advertised for a franchise to build and operate a double-track line in Temple Street, Los Angeles.

Los Angeles (Cal.) Railway.—The Los Angeles Department of Public Utilities has directed the Los Angeles Railway to extend its Western Avenue line from its present terminus at Melrose and Western Avenues to Santa Monica Boulevard and Western Avenue.

Pacific Electric Railway, Los Angeles, Cal.—It is proposed to extend the Spadra line of the Pacific Electric Railway through Corona to connect with the main line near Pomona.

Connecticut Company, New Haven, Conn.—The Connecticut Company plans to make extensive repairs to its East Avenue line, Norwalk, Conn.

Connecticut Company, New Haven, Conn.—The Connecticut Company will rebuild the roadbed of its Berlin-New Britain line and will install new rails.

Danbury & Bethel Street Railway, Danbury, Conn.—The Danbury & Bethel Street Railway will build an extension from West Street to Lake Avenue, Danbury, connecting its West Street and Lake Avenue lines.

Petersburg, Ill.—It is reported that 76 per cent of the right-of-way of a new interurban line between Springfield and Beardstown, Ill., has been secured. With the exception of three miles leading into Springfield the right-of-way is pledged from that city to Chandlerville, Ill., by way of Salisbury, Petersburg and Oakford. The three-mile entrance into the city of Springfield, Ill., is yet to be secured.

Milford & Uxbridge Street Railway, Milford, Mass.—It is proposed to repair the loop line of the Grafton & Upton Railroad, a subsidiary of the Milford & Uxbridge Street Railway, at a cost of $10,000.

Lincoln (Neb.) Traction Company.—The Lincoln Traction Company will repave its right-of-way in Twenty-seventh Street, Lincoln.

Hershey (Pa.) Transit Company.—The Hersey Transit Company is surveying the route of its proposed extension from Lebanon to Fredericksburg, Pa.

Montreal (Que.) Tramways.—The Montreal Tramways will shortly begin the construction of a line from Ahuntsic station to Boulevard Gouin. The line will be 2½ miles long.

Piedmont & Northern Railway, Charlotte, S. C.—The Piedmont & Northern Railway will rebuild the roadbed of its Anderson (S. C.) line.

Power Houses, Shops and Buildings

Kansas City-Western Railway, Kansas City, Kan.—The Wolcott car shops of the Kansas City-Western Railway were destroyed by fire on April 15. The blaze resulted from the explosion of an acetylene torch. The loss is estimated at $150,000.

Trenton & Mercer County Traction Corporation, Trenton, N. J.—The Trenton & Mercer County Traction Corporation plans to build a terminal in the center of the city of Trenton.

Dayton & Troy Electric Railway, Dayton, Ohio.—The carhouse of Dayton & Troy Electric Railway at Tippecanoe City, Ohio, was destroyed by fire on April 14. The company will rebuild at once.

Trade Notes

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has opened an office and warehouse at Jacksonville, Fla.

Norton Company, Worcester, Mass., is building a large six-story addition to its plant which will contain 60,000 sq.ft. of floor space.

J. G. White Company, New York, N. Y., has been recognized in an award by the United States Government for distinguished service, loyalty, energy and efficiency in war kork.

Benjamin Electrical Manufacturing Company, Chicago, Ill., has moved its San Francisco office from 590 Howard Street to 580 Howard Street, occupying the entire four-story building.

American Steam Conveyor Corporation, Chicago, Ill., has developed an air-tight ash-pit door which has a number of features that make it attractive to the power-plant engineer.

Square D Manufacturing Company, Detroit, Mich., has purchased the property of the Peru (Ind.) Electric Manufacturing Company, manufacturer of standard and special porcelain wiring devices.

Elliott Company, Pittsburgh, Pa., manufacturer of power accessories, is now placing upon the market an apparatus which removes substantially all of the air and dissolves gases from boiler-feed water.

E. B. Badger & Sons Company, Boston, Mass., has acquired the American Spray Company, including its engineering personnel. The American Spray Company manufactures spray ponds and air washers designed especially for cleaning the air used to cool generators.

Fairbanks Company, New York, N. Y., has appointed Edward J. Jeep, for many years city sales manager of the Commercial Electrical Supply Company, St. Louis, Mo., as manager of its electrical department in its St. Louis, Mo., branch at Seventh and Market Streets.

Hyatt Roller Bearing Company, New York, N. Y., through the manager of the industrial bearing division, D. Gleisen, announces the removal of its offices to 100 West Forty-first Street, where larger quarters have been secured for advertising, sales and engineering departments of the division.

Mitchell-Rand Manufacturing Company, New York, N. Y., has become the agent and representative of the Sterling Varnish Company and will sell its products at factory prices, making prompt deliveries either from a complete New York stock or from the factory direct.

Graphite Metallizing Corporation, Yonkers, N. Y., which manufactures oilless bearings and impregnates carbons for brushes, has appointed as sales engineer Walter S. Hoyt, who has been for two years assistant to C. A. Greenidge, chief engineer of the J. G. White Management Corporation, New York City.

National Carbon Company, Long Island City, N. Y., American Ever Ready Works branch, has appointed H. S. Schott as Eastern sales manager, succeeding J. H. Somers, resigned. Mr. Schott first became connected with the company in 1913 as a clerk, and after a term as salesman he was transferred to the Canadian Ever Ready organization, where he was promoted to be assistant sales manager.

General Electric Company, Schenectady, N. Y., announces that the new addition to the Windsor works of the General Electric Company will be completed about the first of June and will be ready for occupancy about July 1. The building will be 200 ft. x 70 ft. and will contain two floors and basement, providing 40,000 sq.ft. of floor space. Small electric motors of various horsepowers for direct current are manufactured at the Windsor works.

Material Handling Machinery Manufacturers' Association, New York, N. Y., at a directors' meeting held April 6, elected officers for 1920 as follows: Charles Lang, president Lakewood Engineering Company, president; R. W. Scott, Otis Elevator Company, New York, vice-president; L. C. Brown, Elwell Parker Electric Company, New York, treasurer; and Zenas W. Carter, New York, secretary and manager. Calvin Tompkins, the retiring president, was made an honorary member. Three companies, the Whiting Foundry Equipment Company, Harvey, Ill.; Motors Terminal Company, Cleveland, Ohio, and the C. W. Hunt Company, Inc., West New Brighton, N. Y., were elected to membership in the association.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces that L. A. S. Wood, prominent in illuminating engineering circles both in this country and in Europe, has been appointed manager of the illuminating section of the supply department of the company, with headquarters at South Bend, Ind. He came to this city in 1911 to introduce the flame carbon lamp and was shortly afterward appointed as arc-lamp expert of the Westinghouse Electric & Manufacturing Company, with headquarters at East Pittsburgh, Pa. Soon after the introduction of the "Mazda C" lamp he became associated with the George Cutter Company of South Bend, Ind., as illuminating engineer, and during the past nine years has traveled extensively, taking an active interest in street-lighting improvements in all sections of the country.

Edward R. Ladew Company, Inc., Glen Cove, N. Y., announces that Vance McCarty, general sales manager, has been made vice-president of the company. Mr. McCarty's connection with the house of Ladew covers the past twenty years and embraces every phase of the leather belting business, including manufacture, sale, branch management and general sales direction. He will continue in direct control of Ladew sales policies and has retained as assistant general sales manager Russell B. Reid, another Ladew belting expert with twenty years of leather-belting experience.

Engineering & Appraisal Company, Inc., New York, N. Y., has added to its engineering staff Ralph G. Macy, who has been elected vice-president of the company. Mr. Macy has accordingly resigned as chief engineer of the construction department of the Walter Kidde Company. Mr. Macy has had a long experience in engineering and industrial work, and prior to the war was in charge of the operation of five plants making liquid oxygen and nitrogen.

Professional Note

L. B. Stillwell & H. S. Putnam, consulting engineers, and the L. B. Stillwell Engineering Corporation, constructing engineers, now at 100 Broadway, announce the removal of their offices on May 1 to 143 Liberty St.

New Advertising Literature

Independent Pneumatic Tool Company, Chicago, Ill.: Bulletin No. 95, describing "Thor" pneumatic motor hoist.

International Register Company, Chicago, Ill.: Catalog No. 5, showing all types of fare register now made by this company, together with register backs and repair parts.

United American Metals Corporation, Brooklyn, N. Y.: A reprint of an address, "Selecting the Babbitt," by H. S. Hood, of this company, manufacturer of Syracuse babbitts.

Standard Underground Cable Company, Pittsburgh, Pa.: Bulletin No. 100-1, describing its products, copper, brass tubes, rods and wires. Additional data are included.

PEACOCKS ON YOUR SAFETY CARS

will make your Braking Protection Perfect





"The Peacock Staffless"

If there's any kind of rolling stock that is being watched more carefully than the Safety Car, we don't know of it! Many operators are watching it for lessons in economy and business-building but regulatory officials are watching it from the standpoint of S-A-F-E-T-Y. If the Safety Car is not as safe as it is possible to make it, its other qualities won't count with those who regulate your operation.

Therefore, you cannot afford to have one single preventable accident come along to hurt its reputation.

Experience has already shown that a perfect *standby* brake is even more essential on Safety Cars than on other cars. Frozen air brakes or loss of air with the trolley wheel off have proved the vital need of a brake that would stand by instantaneously for the emergency, *life-saving* stop.

Place the Peacock Brake on your present safeties and specify it upon all your future Safeties. Then and then only will your braking protection be perfect, both on the car and in the courts!

National Brake Company, Inc.

Ellicott Square

Buffalo, N. Y.

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Engineers.
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"NEVER-CREEP"

The Anchor with the CORRECT PRINCIPLE

To install old-fashioned anchors it was necessary to bore the hole in such a manner that the anchor pulled toward the opening of the hole. For this reason the hole required careful filling and tamping after installation, and the anchor then depended on this newly tamped earth for resistance, or holding power.

The NEVER-CREEP pulls only against the solid earth—which is the correct principle—not toward the opening of the hole. Even should the hole remain unfilled, the NEVER-CREEP would have giant strength—and could not creep, give nor lessen its holding power.

ASK YOUR JOBBER

CHANCE COMPANY

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2

Steam and Electric Railway "Checking"

Complicated Interurban and Ohmer Fare Register work a specialty. Confidential Investigations. Write for our proposition, "Prosecuting Dishonest Conductors." We maintain a special department thoroughly equipped for handling all strikes.

The Industrial Protective Company
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WE BUILD TRACKS
Design—Construction—Rehabilitation
ENGEL & HEVENOR
Track Engineers—Contractors
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ELECTRICAL TESTING LABORATORIES
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Scofield Engineering Co. Consulting Engineers PHILADELPHIA, PA.
POWER STATIONS GAS WORKS
HYDRAULIC DEVELOPMENTS ELECTRIC RAILWAYS

THE P. EDW. WISH SERVICE
Suite 1710 DETECTIVES *Suite* 1102
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When writing the advertiser for information or prices, a mention of the Electric Railway Journal would be appreciated.

It will help you train your motormen—

A number of big electric railway companies find that it pays them to place in the hands of each of their motormen a copy of

Gutmann's

THE MOTORMAN AND HIS DUTIES

A handbook of theory and practice of electric railway car operation.

195 *Pages, pocket size*, $1.50

The book explains in simple language, devoid of mathematics and technicalities, many points that will enable the average motorman to take better care of his car and to operate it more efficiently.

The chapter headings are:—

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IV. Overhead Circuit and Third Rail.
V. Electric Railway Motor.
VI. Car Wiring and Parts.
VII. Controllers.
VIII. Multiple-Unit Control.
IX. Operation of Controllers.
X. Brakes and Their Operation.
XI. How to Remedy Troubles.

The last chapter alone should save any company that places this book in the hands of its men a great deal of trouble and expense.

The book is not new—it is in its sixth edition, but it has been found so generally helpful that we venture to bring it again to the attention of electric railway officials.

Examine a copy FREE. Special prices on quantity orders.

Send for a copy for 10 days' FREE examination. Have your employment supervisors go over the book with the needs of your motormen in mind. We will gladly quote you special prices on quantity orders. Use the coupon.

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Give me information concerning special prices on quantity orders for this book.

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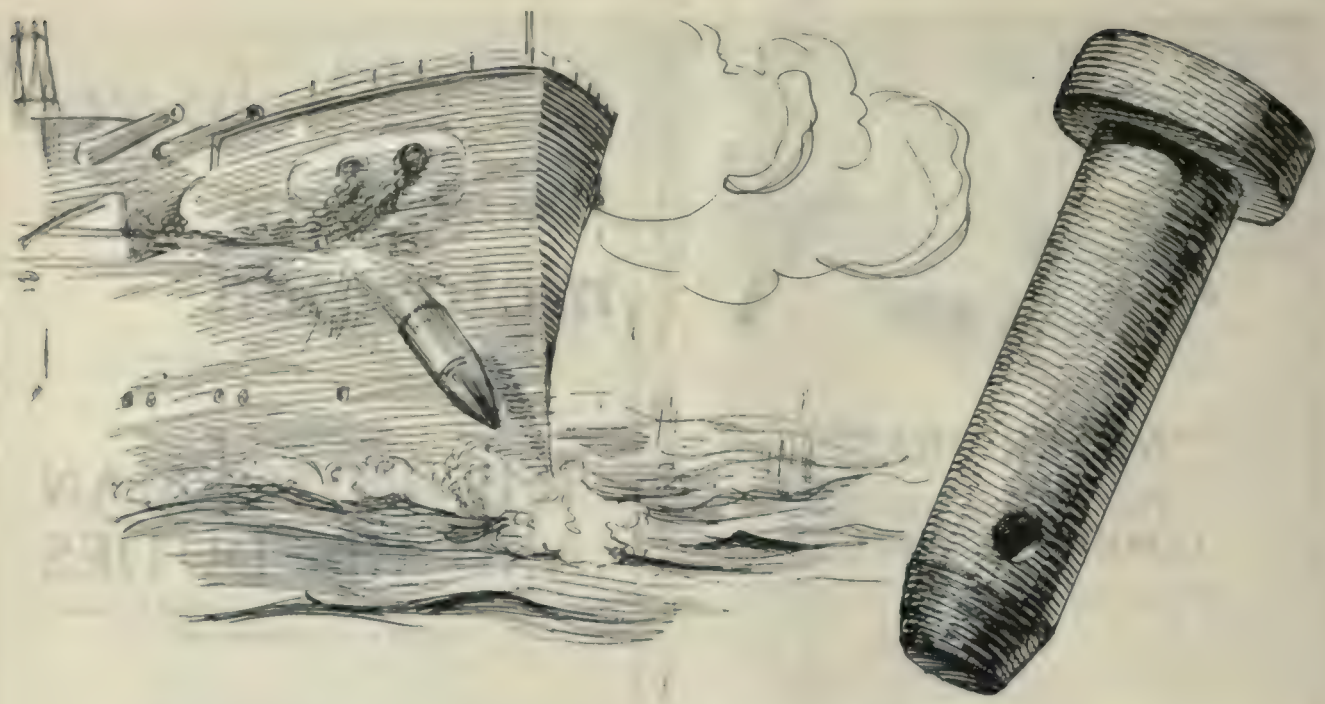
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Boyerizing your brake rigging is like Harveyizing a battleship's armor

Everybody knows what a great advance in armor plate was made with the invention of Harveyized steel.

Now *Boyerized* steel is simply the application of the same principle of super-protection to brake rigging.

While Harveyized steel was intended to minimize the penetration of projectiles, Boyerized steel minimizes the wear caused by the movement of the brake rigging say eight times a mile, seventy-two times an hour, fourteen hundred to fifteen hundred times a day!

Untreated pins and bushings soon wear down under these frequent attacks of the Demon of Wear, the Boyerized kind present a solid, armorized front that permit many miles of service before there is even a caliper reduction in diameter or thickness.

To Boyerize means to lengthen the life of your equipment and to lower the cost of your upkeep.

Other Boyerized Specialties Are:

Boyerized Brake Hangers
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Boyerized Wearing Plates between the Bolster and Bolster Carrier
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SPRINGFIELD MASS

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Other Standard Specifications.
Very prompt deliveries can be made.
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Series Number 29-I

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Steel Tires

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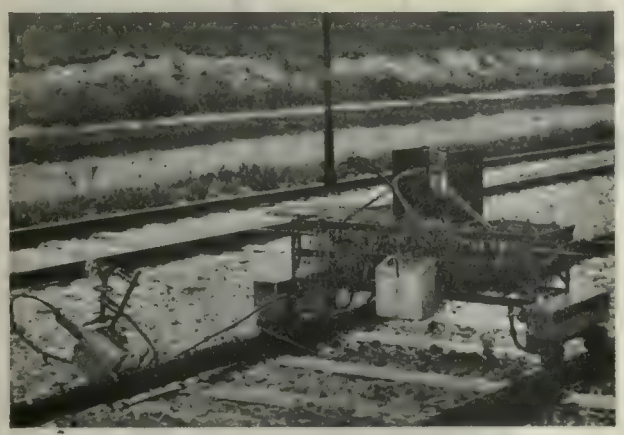
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Preservation of schedule is a law of service. It is a hard law to live up to, if you are not using Our One Man Lightweight Safety Cars. Using the Cars built in the Quality Shops you can give the people better schedules. This means that a higher price will be paid for transportation. St. Louis Car Co., Safety Cars, and Service, mean the same—Satisfaction.

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St. Louis, Mo.

"The Birthplace of the Safety Car"



You can average 100 Bonds per day on a job like this with the portable ERICO

ONE hundred a day is a conservative estimate. Averages as high as 120 in 8½ hours are not unusual.

For straight away bonding or for pickup jobs thruout the system you'll find the Erico equally efficient. It saves labor, too. Only two men are required—one for grinding and cleaning and one to do welding.

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CarnegieSteelGearBlanks

When buying gears from your gear cutter insist that they be cut from Carnegie Blanks because—

1. One hundred per cent of the blanks can be turned into finished gears. Hidden blow holes need not be anticipated after completion of expensive machine work.
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Real gear economy consists in purchasing only those gears which have a good performance record and are made by a responsible organization. Gears cut from Carnegie Blanks fulfill both these conditions. The engineers of this company will gladly confer with you as to better service in gear transmission.

Carnegie Steel Company

General Offices: Carnegie Building, Pittsburgh, Pa.

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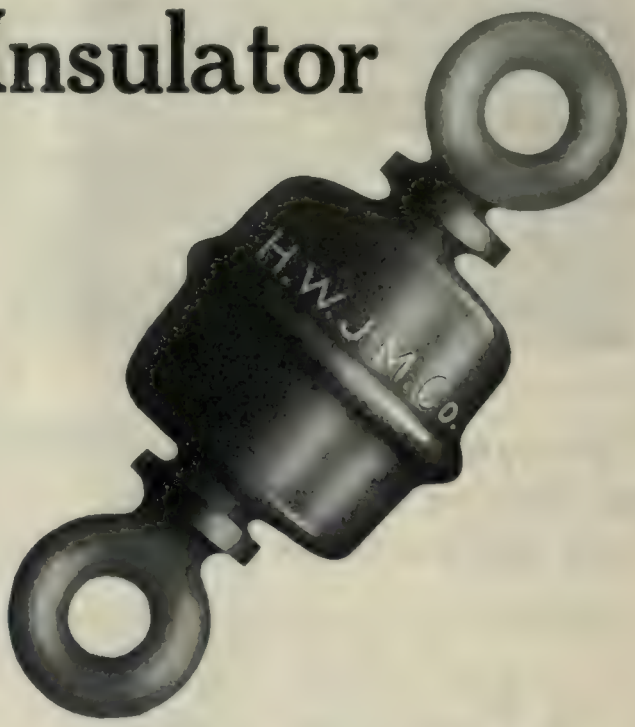
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1376 Elec Ry Cars in state
of which
1220 are operated by Companies
which regularly use
"Tool Steel" Gears + Pinions

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Watch for your state!

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YOU have other things to do than be bothered with replacing broken strain insulators. That's why we make the Giant Strain Insulator so good you can put it in service and forget it.

For instance, we use Mica Discs between metal parts that keep Giant Strain Insulators *insulators* long after the ordinary commercial kinds are scrapped.

And if its strength plus permanent insulation you're after, let us give you more complete information about the Giant Strain Insulator.

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10 Factories—Branches in 63 Large Cities

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We have manufactured tickets exclusively for nearly forty years and are constantly designing new forms to efficiently care for all present-day operating conditions.

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EMB Grid Resistors

ARE MADE RIGHT AND STAY RIGHT

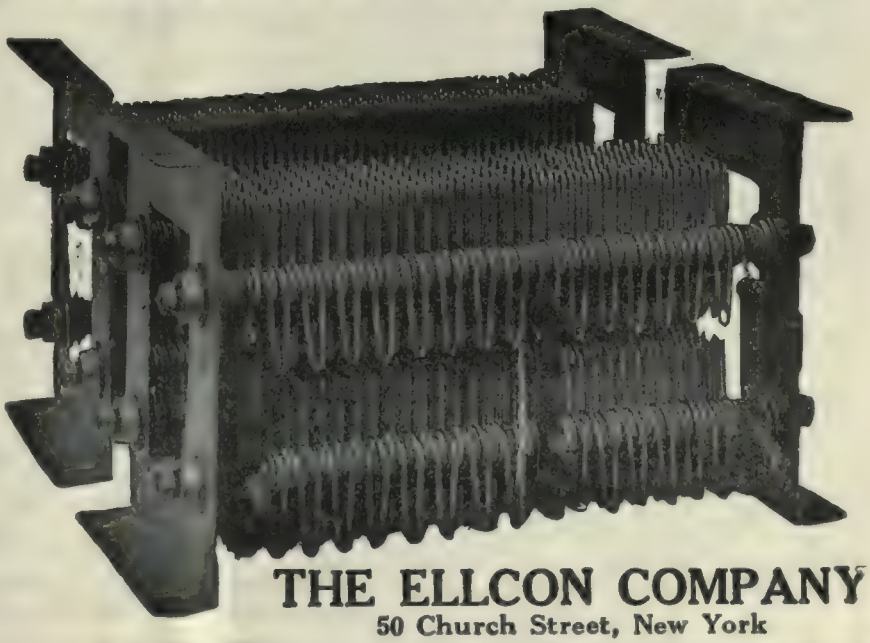
No resistors get more abuse than those under a car.

They are abused electrically by careless operation of the controller.

They are abused mechanically by exposure to dusty, muddy and stone-littered streets.

Until the arrival of E M B drawn, non-corroding grid resistors, troubles from these sources seemed unavoidable.

E M B grid resistors actually have made this part of your equipment troubleproof.



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HARPS

Malleable iron is the proven material to make trolley harps from.

This material, used in Nuttall harps, has high resistance to wear. The steel shanks are riveted firmly in place and the contact springs and washers are placed so that they do not touch the cutting edge of the swiftly rotating trolley wheel.

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Nuttall Helical Gears

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GRIFFIN F. C. S. WHEELS

For Street and Interurban Railways

All of our plants have adequate facilities for fitting wheels to axles.

FOUNDRIES:

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Van Dorn Car and Air Couplers

For Heavy City and Medium Heavy Interurban Service



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No. 1200 CAR and AIR COUPLER

Vertical Pivoting **Tight Lock** **Equipped with No. 1160 Draft Gear**

Couples car and air connections automatically by impact. **Vertical Pivoting Head** relieves platform strains at sharp changes in grade. **Spring Head Support** holds coupler head at proper height for coupling. Draft gear and coupler head give maximum radial clearance. Perfectly protected rubber gaskets eliminate air leakage. Radial movement, 120°.

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1

MAKE YOUR PARK PAY

Your biggest Park expense can be greatly reduced

A WELTE ORCHESTRION

Supplying the Music Insures Your Success

Our
AUTOMATIC BRASS BANDS
provide just as good music as any full band and our
DANCE HALL INSTRUMENTS
offer the services of a complete orchestra.

Will save their cost in one season

Morning and afternoon attractions now possible—without extra cost.

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A WELTE ORCHESTRION in the Auditorium of the Milwaukee Electric Light & Railway Co.

1870 EUGENE F PHILLIPS 1882 AMERICAN ELECTRICAL WORKS

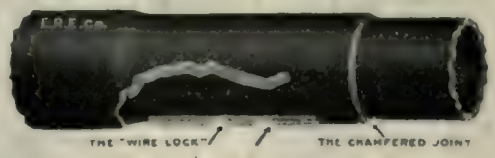
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Lowest Cost — Lightest Weight
Least Maintenance — Greatest Adaptability
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Made by
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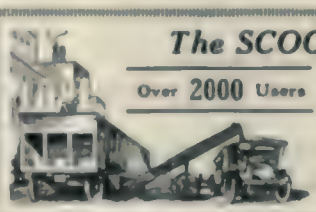
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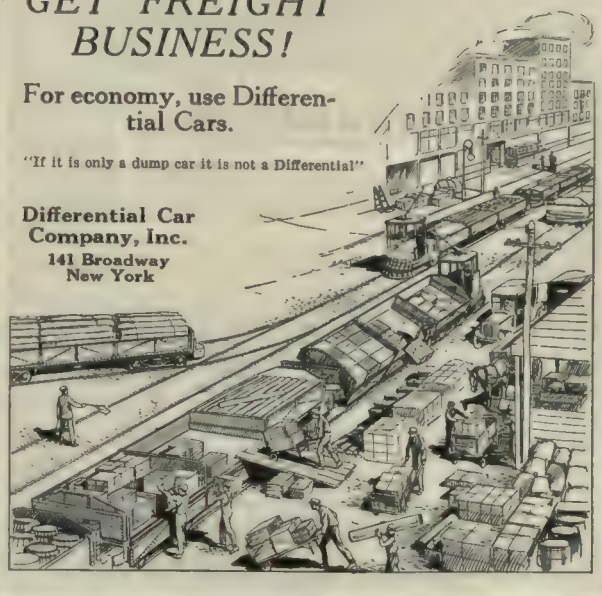
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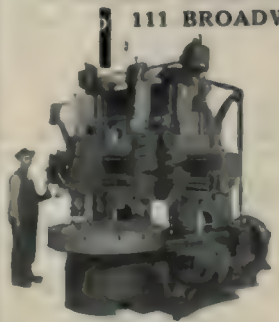
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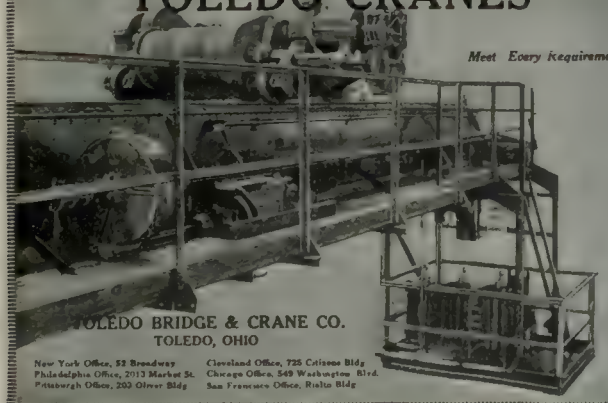
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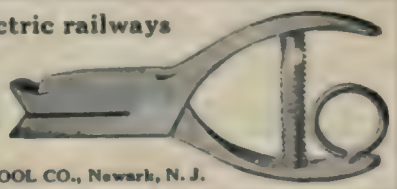
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CHIEF engineer or assistant chief, 8,000 kw. Ohio electric generating plant, tubo and comp. Corliss condensing units; an aggressive man (preferably age 35 or 40), who can handle men, is willing to assume responsibility and who knows combustion and can produce results, is required. Address, P-631, Elec. Ry. Journal, Leader-News Bldg., Cleveland.

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State price and delivery and at what point cars may be inspected. Give full description in first letter.

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EXCELLENT CONDITION

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Rails cut to lengths for all purposes.

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700	tons	85's	300	tons	75's
430	tons	80's	1200	tons	70's
200	tons	75's	800	tons	65's
240	tons	70's	1500	tons	60's
85	tons	65's	4000	tons	56's
500	tons	60's	1100	tons	50's
100	tons	40's	200	tons	45's
20	tons	30's	2000	tons	40's
100	tons	24's	840	tons	35's
330	tons	20's	430	tons	30's
150	tons	16's	230	tons	25's
126	tons	12's	340	tons	20's
17	tons	8's			

10 tons, 7 inch, 70 lb., Shanghai.
110 tons, 9 inch, 90 lb., Grooved Girder.

Good Stock *Prompt Shipment*

ZELNICKER IN ST. LOUIS

Get our new 100 page bargain bulletin No. 280 for exceptional offering in Cars, Locomotives, new and used Switch Material, Angle Bars, Tie Plates, Rail Braces, Pipe, Piling, Tanks, Engines, Generators, Boilers, Machine Tools, etc.

FOR SALE
6—50-FT.
Interurban Cars
Complete

Mounted on Standard C-60-P Trucks; 4 West. No. 56 Motors.

Electric Equipment Co.
Philadelphia, Pa.

Caution—RAIL USERS

If you contemplate needing more track during 1920, BUY NOW. There will be a SCARCITY. We own and offer the following NEW RAILS for prompt shipment:

New 12-lb. Rails, splices, bolts and nuts.
New 30-lb. Rails, angle bars, bolts and nuts.
70-lb. ASCE Relayers.
New 80-lb. Rails, angle bars, bolts, nuts and spikes.
New 90-lb. Rails, angle bars, bolts, nuts and spikes.

They will be gone soon. Write or wire for our quotations.

HYMAN-MICHAELS COMPANY
531 Peoples Gas Bldg., Chicago

BRANCH OFFICES: First National Bank Bldg., Pittsburgh, Pa.; Railway Exchange Bldg., St. Louis, Mo.; East Chicago, Ind.
YARDS AND WAREHOUSES: East Chicago, Ind. and St. Louis, Mo.

WORRYLESS ELECTRICAL REPAIRS
On all kinds and sizes A.C. or D.C. motors and generators, starters, welders, controllers, or anything electrical. Quick shipment from stock material of coils, commutators—shafts—bearings, etc. Remember our initials stand for our product.

CAREFUL CLEVELAND ACCURATE ARMATURE WORRYLESS WORKS, Inc.

EST. 1895 4732-4-6 ST. CLAIR AVE., CLEVELAND INC. 1918

Electric Railway for Sale!

We have purchased the entire equipment of the Cincinnati & Columbus Traction Co., which was operated from Norwood to Hillsboro, O., a distance of approximately 53 miles, and offer for sale the following:

RAILS—

4000 tons No. 1, 70-lb. relaying steel rails.

WIRE—

500,000 lb. or more of copper trolley, feeder, high tension, etc.

POWER EQUIPMENT—

6—Babcock & Wilcox Boilers, 165-lb. pressure, equipped with American Stokers, forced and induced draft, and economizers.
2—Corliss Engines.
Generators.
Switchboards and Transformers.
2—Rotary Converters.

ROLLING STOCK (Standard Gauge)—

Suitable for Industrials only.
5—Box Cars.
3—Flat Cars.
1—Derrick Car.
5—Gondolas.
3—Gondola Cars, Center Dump.

A number of all steel Bridges for quick acceptance at $1.00 per 100 lbs. as is

Write or wire us, stating just what you are interested in, and we will be pleased to submit quotations and further particulars.

HYMAN-MICHAELS COMPANY

(Refer to Department J)

People's Gas Building, Chicago, Ill.

Branches: New York City—Pittsburgh—St. Louis

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Electric Railway Industry with Names of Manufacturers and Distributors Advertising in this Issue

Advertising, Street Car
Collier, Inc., Barron G.

Air Aftercoolers
Ingersoll-Rand Co.

Air Receivers
Ingersoll-Rand Co.

Ammeters
Weston Electrical Instrument Co

Anchors, Guy
Chance Co., The
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Angle Bars
Lackawanna Steel Co.

Ash Storage Tanks, Cast Iron
Green Engineering Company

Automobiles and Buses
Brill Co., The J. G.

Axles
Cambria Steel Co.
Midvale Steel & Ordnance Co.

Axle Straighteners
Columbia M. W. & M. I. Co.

Axles, Car Wheel
Bemis Car Truck Co.
Brill Co., The J. G.
Carnegie Steel Co.
St. Louis Car Co.
Standard Steel Works Co.
Westinghouse Elec. & Mfg. Co.

Babbitt Metal
More-Jones Brass & Metal Co.

Babbitting Devices
Columbia M. W. & M. I. Co.

Badges and Buttons
Electric Service Supplies Co.
International Register Co., The

Batteries, Dry
Johns-Manville Co., H. W.

Batteries, Storage
Electric Storage Battery Co.

Bearings and Bearing Metals
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
More-Jones Brass & Metal Co.
St. Louis Car Co.
Westinghouse Elec. & Mfg. Co.

Bearings, Center and Roller Side
Stucki Co., A.

Bells and Gongs
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
St. Louis Car Co.

Benders, Rail
Sales-Bement-Pond Co.

Boilers
Babcock & Wilcox Co.

Boiler Tubes
National Tube Co.

Bond Testers
American Steel & Wire Co.
Rail Welding & Bonding Co.

Bonding Apparatus
American Steel & Wire Co.
Electric Railway Improv. Co.
Electric Service Supplies Co.
Ohio Brass Co.
Rail Welding & Bonding Co.

Bonds, Rail
Electric Railway Improv. Co.
Electric Service Supplies Co.
General Electric Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Rail Welding & Bonding Co.
Westinghouse Elec. & Mfg. Co.

Book Publishers
McGraw-Hill Book Co., Inc.

Boring Tools, Car Wheel
Sales-Bement-Pond Co.

Brackets and Cross Arms (See also Poles, Ties, Posts, Etc.)
Bates Expanded Steel Truss Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Hubbard & Co.
Lundy Bros. Co.
Ohio Brass Co.

Brake Adjusters
National Ry. Appliance Co.
Westinghouse Traction Brake Co.

Brake Shoes
Amer. Brake Shoe & Fdry. Co.
Barbour-Stockwell Co.
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
St. Louis Car Co.

Brakes, Brake Systems and Brake Parts
Bemis Car Truck Co.
Brill Co., The J. G.
Columbia M. W. & M. I. Co.
General Electric Co.
National Brake Co.
St. Louis Car Co.
Safety Car Devices Co.
Westinghouse Traction Brake Co.

Bricks, Fire
Green Engineering Co.

Brooms, Track, Steel or Rattan
Zelnicker, W. A., Supply Co., Inc.

Brushes, Carbon
General Electric Co.
Jeandron W. J.
United States Graphite Co.
Westinghouse Elec. & Mfg. Co.

Brushes, Graphite
United States Graphite Co.

Brush Holders
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.

Bushings, Case Hardened and Manganese
Bemis Car Truck Co.

Bushings, Graphite and Wooden
Bound Brook Oilless Bearing Co.

Cables. (See Wires and Cables)

Carbon Brushes. (See Brushes, Carbon)

Car Panel Safety Switches
Westinghouse Elec. & Mfg. Co.

Cars, Dump
Differential Car Co.

Cars, Passenger, Freight, Express, etc.
American Car Co.
Brill Co., The J. G.
Cambria Steel Co.
Kuhlman Car Co., G. C.
McGuire-Cummings Mfg. Co.
Midvale Steel & Ordnance Co.
National Ry. Appliance Co.
St. Louis Car Co.
Wason Mfg. Co.

Cars, Second Hand
Electric Equipment Co.

Cars, Self-Propelled
Electric Storage Battery Co.
General Electric Co.

Castings, Brass, Composition or Copper
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Eureka Co.
More-Jones Brass & Metal Co.

Castings, Gray Iron and Steel
American Steel Foundries
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.
Standard Steel Works Co.

Castings, Malleable and Brass
Amer. Brake Shoe & Fdry. Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
St. Louis Car Co.

Catchers and Retrievers, Trolley
Electric Service Supplies Co.
Ohio Brass Co.
Wood Co., Chas. N.

Checking
Industrial Protective Co.

Circuit Breakers
Automatic Reclosing Circuit Breaker Co.
Cutter Electrical & Mfg. Co., The
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps and Connectors for Wires and Cables
Anderson Mfg. Co., A. & J. M.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Cleaners and Scrapers—Track (See also Snow-Plows, Sweepers and Brooms)
Brill Co., The J. G.
Ohio Brass Co.

Clusters and Sockets
General Electric Co.

Coal and Ash Handling. (See Conveying and Hoisting Machinery)

Coil Banding and Winding Machines
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Coils, Armature and Field
Cleveland Armature Works
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Westinghouse Elec. & Mfg. Co.

Coils, Choke and Kicking
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Coin-Counting Machines
Electric Service Supplies Co.
International Register Co., The
Johnson Fare Box Co.

Comeiong
Bush Electric Co.

Commutator Slotters
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Commutator Truing Devices
General Electric Co.

Commutators or Parts
Cameron Electrical Mfg. Co.
Cleveland Armature Works
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Compressors, Air
Chicago Pneumatic Tool Co.
General Electric Co.
Ingersoll-Rand Co.
Westinghouse Trac. Brake Co.

Compressors, Gas
Ingersoll-Rand Co.

Condensers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Conduit Fittings
Chicago Fuse Mfg. Co.

Conduits, Underground
Johns-Manville Co., H. W.

Connectors, Solderless
Frankel Connector Co.
Westinghouse Elec. & Mfg. Co.

Controller Fingers
Russell Mfg. Co.

Controllers or Parts
Columbia M. W. & M. I. Co.
Eureka Co.
General Electric Co.
Russell Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Controller Regulators
Elec. Service Supplies Co.

Controlling Systems
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Converters, Rotary
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Conveyors, Belt
Portable Machinery Co.

Conveyors, Coal and Ash
Green Eng. Co.
Portable Machinery Co.

Conveyors, Portable
Portable Machinery Co.

Conveying and Hoisting Machinery
Columbia M. W. & M. I. Co.
Green Eng. Co.
Portable Machinery Co.

Copper Wire
Anaconda Copper Mining Co.

Cord, Bell, Trolley, Register, etc.
Brill Co., The J. G.
Electric Service Supplies Co.
International Register Co., The
Roebling's Sons Co., John A.
Samson Cordage Works

Cord Connectors and Coup'ers
Electric Service Supplies Co.
Samson Cordage Works
Wood Co., Chas. N.

Couplers, Car
Brill Co., The J. G.
Ohio Brass Co.
Van Dorn Coupler Co.
Westinghouse Trac. Brake Co.

Cranes
Sales-Bement-Pond Co.
Toledo Bridge & Crane Co., The

Creosoting. (See Wood Preservatives)

Cross Arms. (See Brackets)

Crossing Foundations
International Steel Tie Co.

Crossing Signals. (See Signals, Crossing)

Crossings, Frog & Switch
Wharton Jr., & Co., Wm.

Crossings, Track. (See Track, Special Work)

Culverts
Armco Iron Culvert & Flume Mfrs. Assn.
Canton Culvert & Silo Co.

Curtains and Curtain Fixtures
Brill Co., The J. G.
Electric Service Supplies Co.
St. Louis Car Co.

Cutouts
Chicago Fuse Mfg. Co.

Dealers' Machinery
Archer & Baldwin
Electric Equipment Co.
Foster Co., L. B.
Hyman Michaels Co.

Derailing Devices. (See also Track Work)
Cleveland Frog & Crossing Co.

Destination Signs
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.

Detective Service
Wish Service, P. Edward

Dogs, Lathe
Williams & Co., J. H.

Door Operating Devices
Consolidated Car Heating Co.
National Pneumatic Co., Inc.
Safety Car Devices Co.

Doors and Door Fixtures
Brill Co., The J. G.
General Electric Co.

Doors, Folding Vestibule
National Pneumatic Co., Inc.

Draft Rigging. (See Couplers)

Drills, Rock
Ingersoll-Rand Co.

Drills, Track
American Steel & Wire Co.
Chicago Pneumatic Tool Co.
Electric Service Supplies Co.
Niles-Bement-Pond Co.
Ohio Brass Co.

Drinking Cups, Sanitary Paper
Individual Drinking Cup Co., Inc.

Dryers, Sand
Electric Service Supplies Co.
Zelnicker Supply Co., Inc.
Walter A.

Electrical Wires and Cables
Roebling's Sons Co., J. A.

Engineers, Consulting, Contracting and Operating
Archbold-Brady Co.
Arnold Co., The
Byllesby Co., Inc., H. M.
Clark Management Corp., E. W.
Engel & Bevenor
Feustel, Robert M.
Ford, Bacon & Davis
Holst, Englehardt W.
Jacobs & Co., J. L.
Kelly, Cooke & Co.
Republic Engineers, Inc.
Richey, Albert S.
Robinson & Co., Dwight P.
Sanderson & Porter
Scofield Engineering Co.
Stone & Webster
White Engineering Corp., The J. G.

Engines, Gas, Oil or Steam
Ingersoll-Rand Co.
Westinghouse Elec. & Mfg. Co.

Fare Boxes
Brill Co., The J. G.
Johnson Fare Box Co.
National Railway Appliance Co.

Fences, Woven Wire and Fence Posts
American Steel & Wire Co.

Fenders and Wheel Guards
Brill Co., The J. G.
Consolidated Car Fender Co.
Electric Service Supplies Co.
Star Brass Works.

Fibre and Fibre Tubing
Westinghouse Elec. & Mfg. Co.

Field Coils. (See Coils)

Filters, Water
Scaife & Sons Co., Wm. B.

Fire Extinguishing Apparatus
Castle, Inc., James M.

Floodlights
Crouse-Hinds Co.
Electric Service Supplies Co.

Flooring Composition
American Mason Safety Tread Co.

Flooring, Grating
Irving Iron Works

Forgings
Carnegie Steel Co.
Columbia M. W. & M. I. Co.
Eureka Co.
Standard Forging Co.
Standard Steel Works Co.
Williams & Co., J. H.

Frogs, Track. (See Track Work)

Funnel Castings
Wharton, Jr., Inc., & Co., Wm.

Fuses and Fuse Boxes
Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
D & W Fuse Co.
General Electric Co.
Johns-Manville Co., H. W.
Multiple Electric Products Co.
Westinghouse Elec. & Mfg. Co.
Williams & Co., J. H.



There is a Weston instrument to meet every requirement.

Weston Indicating Instruments include a great variety of groups for portable or switchboard service on A. C. or D. C. Circuits. Instruments designed expressly for testing and laboratory use, for motor car and boat electrical systems, and many others for special purposes. Write for Bulletins or Catalogs describing those which interest you.

—for Accurate Testing

It is often necessary to conduct power tests under conditions that are far from favorable.

Here is a portable instrument that fulfills the most exacting requirements on both A. C. and D. C. circuits. The

Weston

MODEL 310 PORTABLE

Single-Phase and D. C. Wattmeter

is extremely accurate (guaranteed within one-fourth of 1% of full scale value.)

It may be used on A. C. circuits of any commercial frequency and has a large overload capacity. Other characteristics are: low moment of inertia; effective damping and shielding; and the legibility and remarkable uniformity of the hand-calibrated scale.

Weston Indicating Instruments have been for thirty-two years the accepted standard of the world.

Weston Electrical Instrument Co.

21 Weston Ave., Newark, N. J.

Branch Offices in All Principal Cities of the United States and throughout the World.

A Dependable Outlet for Enamel Magnet Wire

For those who require better insulation than the ordinary cotton and silk covering affords. This new Enamel wire will give the desired results.

When used with cotton and silk covering it gives a much increased insulation value.

When used without cotton or silk covering it takes up much less space and has good insulation value.

Will not crack when bent and will not get brittle when subjected to high temperatures.

Write for details.

Independent Lamp & Wire Co., Inc.

OFFICES:
1737 Broadway, New York

FACTORIES:
York, Pa., and Weehawken, N. J.

Be Independent of Coil Trouble use SALAMANDER Pure Asbestos

During the rush hours when your motors are greatly overloaded and become excessively hot you need not have any fear of burnouts if the coils are insulated with Salamander Pure Asbestos. It will not burn no matter how hot it gets.

Send us your burnout coils and let us rewind them for you. We are in a position to rush work, thereby helping you out of your difficulties.

Independent Lamp & Wire Co., Inc.

OFFICES:
1737 Broadway, New York

FACTORIES:
York, Pa., and Weehawken, N. J.

WHAT AND WHERE TO BUY

Fuses, Refillable
Chicago Fuse Mfg. Co.
Columbia M. W. & M. I. Co.
General Electric Co

Fuse, Removers
Bush Electric Co

Gages, Oil and Water
Ohio Brass Co.

Gaskets
Power Specialty Co.
Westinghouse Traction Brake Co

Gas-Electric Cars
General Electric Co.

Gas Producers
Westinghouse Elec. & Mfg. Co.

Gates, Car
Brill Co., The J. G.

Gear Blanks
Carnegie Steel Co.
Standard Steel Works Co.

Gear Cases
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
Westinghouse Elec. & Mfg. Co.

Gears and Pinions
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
National Railway Appliance Co.
Nuttall Co., R. D.
Tool Steel Gear & Pinion Co.

Generating Sets, Gas-Electric
General Electric Co.

Generators
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Gongs. (See Bells and Gongs)

Grates, Chain
Green Eng. Co.

Greases. (See Lubricants)

Grinders and Grinding Supplies
Indianapolis Switch & Frog Co.
Metal & Thermit Corp.
Railway Track-work Co.

Grinding Blocks and Wheels
Railway Track-work Co.

Guards, Trolley
Electric Service Supplies Co.
Ohio Brass Co.

Harps, Trolley
Anderson Mfg. Co., A. & J. M.
Electric Service Supplies Co.
More-Jones B. & M. Co.
Nuttall Co., R. D.
Star Brass Works

Headlights
Crouse-Hinds Co.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
St. Louis Car Co.

Heaters, Car (Electric)
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
National Ry. Appliance Co.
Smith Heater Co., Peter

Heaters, Car, Hot Air and Water
Cooper Heater Co.
Smith Heater Co., Peter

Heaters, Car (Stove)
Electric Service Supplies Co.
Smith Heater Co., Peter

Hoists and Lifts
Columbia M. W. & M. I. Co.
Ford Chain Block Co.
Niles-Bement-Pond Co
Toledo Bridge & Crane Co., The

Hose
Ingersoll-Rand Co.

Hose, Bridges
Ohio Brass Co

Hydraulic Machinery
Niles-Bement-Pond Co.

Inspection
Electrical Testing Lab'ts

Instruments, Measuring, Testing and Recording
Economy Electric Devices Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Insulating Cloth, Paper and Tape
Borden Mfg. Co
General Electric Co
Johns-Manville Co., H. W.
Westinghouse Elec. & Mfg. Co.

Insulation. (See also Paints)
Anderson M. Co., A. & J. M.
Electric Ry. Equipment Co
Electric Service Supplies Co
General Electric Co.
Johns-Manville Co., H. W.
Mica Insulator Co.
Westinghouse Elec. & Mfg. Co

Insulators. (See also Line Material)
Anderson M. Co., A. & J. M.
Ohio Brass Co.
Electric Railway Equipment Co
Electric Service Supplies Co
General Electric Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co

Insulator Pins
Electric Service Supplies Co
Hubbard & Co

Jacks. (See also Cranes, Hoists and Lifts)
Brill Co., The J. G.
Buckeye Jack Mfg. Co.
Columbia M. W. & M. I. Co.
Templeton, Kenly Co., Ltd.

Joints, Rail
Carnegie Steel Co.
Rail Joint Co.
Zelnicker Supply Company, Inc., Walter A.

Journal Boxes
Bemis Car Truck Co.
Brill Co., J. G.

Lamp Guards and Fixtures
Anderson M. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Arc and Incandescent. (See also Headlights)
Anderson M. Co., A. & J. M.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Signal and Marker
Ohio Brass Co.

Lathe Attachments
Williams & Co., J. H.

Lathes, Car Wheel
Niles-Bement-Pond Co.

Lightning Protection
Anderson M. Co., A. & J. M.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Line Material. (See also Brackets, Insulators, Wires, etc.)
Anderson M. Co., A. & J. M.
Archbold-Brady Co.
Chance Co., The
Columbia M. W. & M. I. Co.
Drew Electric & Mfg. Co.
Electric Railway Equipment Co.
Electric Service Supplies Co.
Eureka Co.
General Electric Co.
Hubbard & Co.
Johns-Manville Co., H. W.
More-Jones B. & M. Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Loaders, Wagon, Truck or Car
Portable Machinery Co.

Locking Spring Boxes
Wharton, Jr. & Co., Wm.

Locomotives, Electric
Brill Co., The J. G.
General Electric Co.
McGuire-Cummings Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Lubricating Engineers
Galena-Signal Oil Co.

Lubricants, Oil and Grease
Galena-Signal Oil Co.

Machine Tools
Columbia M. W. & M. I. Co.
Niles-Bement-Pond Co.

Machine Work
Columbia M. W. & M. I. Co.

Manganese Steel Castings
Wharton, Jr., & Co., Wm.

Manganese Steel Special Track Work
Wharton, Jr., & Co., Wm.

Meters, Car, Watt-Hour
Economy Electric Devices

Meters. (See Instruments)
Electric Service Supplies Co.

Mirrors for Motormen
Drew Elec. & Mfg. Co.

Motormen's Seats
Electric Service Supplies Co.
Wood Co., Chas. N.

Motors, Electric
Westinghouse Elec. & Mfg. Co

Motors and Generators, Sets
General Electric Co

Nuts and Bolts
Barbour-Stockwell Co.
Bemis Car Truck Co.
Columbia M. W. & M. I. Co.
Hubbard & Co.

Ohmmeters
Weston Elec'l Instrument Co

Orchestrions
Wolfe & Sons, Inc., M.

Oils. (See Lubricants)

Oxy-Acetylene. (See Cutting Apparatus, Oxy-Acetylene)

Packing
Westinghouse Elec. & Mfg. Co.

Paints and Varnishes (Insulating)
Mt. Hell-Rubber Mfg. Co.

Paints & Varnishes, Preservative
Johns-Manville Co., H. W.
St. Louis Surfacer & Paint Co.

Paints and Varnishes for Woodwork
National Ry. Appliance Co.

Paving Material
American Brake Shoe & Fdry. Co.
Barrett Co., The

Paving Pitch
Barrett Co., The

Pickups, Trolley Wire
Electric Service Supplies Co.
Ohio Brass Co.

Pinion Pullers
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
General Electric Co.
Wood Co., Chas. N.

Pinions. (See Gears)

Pins, Case Hardened, Wood and Iron
Bemis Car Truck Co.
Electric Service Supplies Co.
Ohio Brass Co.
Westinghouse Traction Brake Co.

Pipe
National Tube Co.

Pipe Fittings
Power Specialty Co.
Standard Steel Works Co.
Westinghouse Traction Brake Co.

Planers. (See Machine Tools)

Pliers, Insulated
Electric Service Supplies Co.

Pneumatic Tools
Ingersoll-Rand Co.

Pole Reinforcing
Hubbard & Co.

Poles, Metal Street
Bates Expanded Steel Truss Co.
Electric Railway Equipment Co.
Hubbard & Co.

Pole Sleeves
Drew Elec. & Mfg. Co.

Poles, Ties, Posts, Piling and Lumber
Lindsley Bros. Co.

Poles and Ties, Treated
Lindsley Bros Co.

Poles, Trolley
Anderson Mfg. Co., A. & J. M.
Columbia M. W. & M. I. Co.
Electric Service Supplies Co.
National Tube Co.
Nuttall Co., R. D.

Poles, Tubular Steel
Electric Railway Equipment Co.
National Tube Co.

Power Saving Devices
Arthur Power-Saving Recorder Co.
Economy Electric Devices Co.
National Ry. Appliance Co.

Preservatives
Barrett Co., The

Pressure Regulators
General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Pumps
Schutte & Koerting Co.

Punches, Ticket
Bonney-Vehslage Tool Co.
International Register Co., The
Wood Co., Chas. N.

Purifiers, Feed Water
Scaife & Sons Co., Wm. B.

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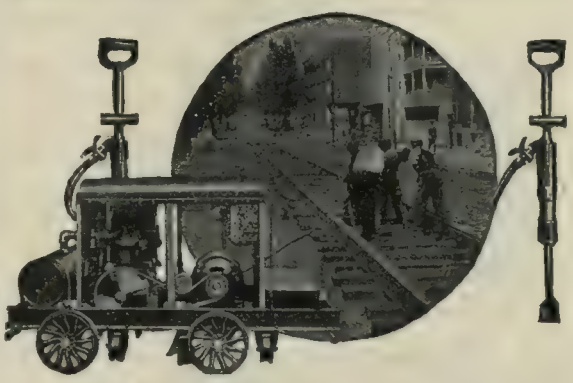
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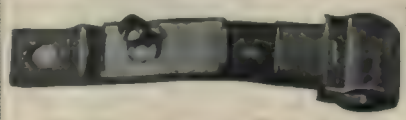
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Creosoted Poles for Permanency—

The "*permanency*" demanded of wood poles is assured by proper creosoting treatment. Proper treatment* means the Open Tank process—hot and cold treatment—and insures thorough impregnation of the sapwood. Best results are assured by following the recommendations suggested herewith, and using Carbosota Creosote Oil.

**In this instance the reference is to cedar and chestnut poles.*

Recommendations for Butt Treatment of Cedar and Chestnut Poles by the Open Tank Process

CONDITION OF POLES. Poles should be seasoned until air-dry, and otherwise conform to standard specifications.

PREPARATION OF POLES. Of the surface to be creosoted, the area between a point one to two feet above, and a point 2 to 3 feet below the future ground line should be carefully cleaned of all adhering inner bark, or other foreign substance. Parts of the exterior surface showing soft or brashy wood should be shaved clean, until sound wood is exposed.



TREATMENT. Pole-butts should be completely immersed in the preservative to a point two feet above the future ground line.

HOT TREATMENT. When treating tank has been charged, creosote oil should be admitted at a temperature of about 150 degrees F. and thereafter maintained at between 200 degrees F. and 220 degrees F. for the required period.

COLD TREATMENT. At the end of the "hot period" the cold creosote oil should be admitted until the temperature of the creosote drops a hundred degrees, whereupon cold treatment should continue for the required period.

The level of oil in treating tank should be maintained uniform. Portion of pole being creosoted should not be exposed to atmosphere during treatment.

IMPREGNATION. The object of the treatment is to obtain complete impregnation of the sapwood. It should be required that the average visible penetration of the creosote oil should not be less than 50% of the depth of the sapwood ring.

Inspection should be by borings made with a Swedish increment borer, or similar instruments which recover an intact core of wood.

PRESERVATIVE. The preservative to be used should be a pure refined coal-tar creosote oil, meeting standard specifications. ("Carbosota Creosote Oil" is an identification mark—guaranteeing uniformity and efficiency.)

Green, or frozen poles should not be treated under these specifications.

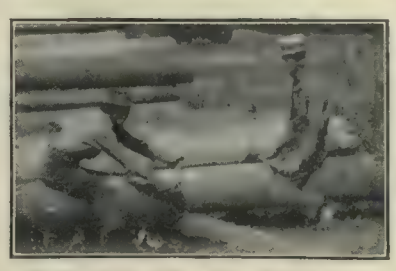
TOPS, GAINS, ETC. Tops, gains and abrasions should be given a two-coat brush application of Carbosota Creosote Oil, heated to about 150 degrees F. (Note—Small plants can give treatment in accordance with these recommendations by maintaining the required period of hot treatment, and thereafter permitting both oil and poles to cool to atmospheric temperatures.)

Technical service, detailed recommendations, etc., for application of wood preservation obtainable gratis by addressing nearest office.

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Shaving ground line area of pole before treatment.



"Snaking" shaved pole to creosoting tanks.



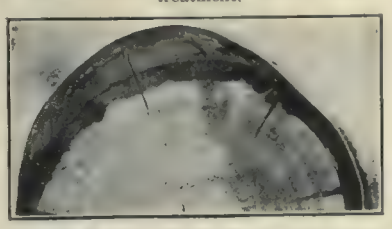
Modern open tank process commercial pole treating plant. Western Wood Preservers, Sandpoint, Idaho (W. C. Assoc.).



Carload of butt-treated Western red cedar poles leaving creosoting plant.



Dipped short-time treatment or surface treatment.



Open tank process (hot and cold treatments). Note thorough impregnation of sapwood.

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Over six million feet used without accident being reported within the knowledge of the manufacturer.
Our products are used on all leading railroads, cars and stations. For details address: AMERICAN MASON SAFETY TREAD CO., Lowell, Mass.
Branch offices: Boston, New York, Chicago, Philadelphia.
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SURPACO

Sur-Lin-O

Instead of Linseed Oil

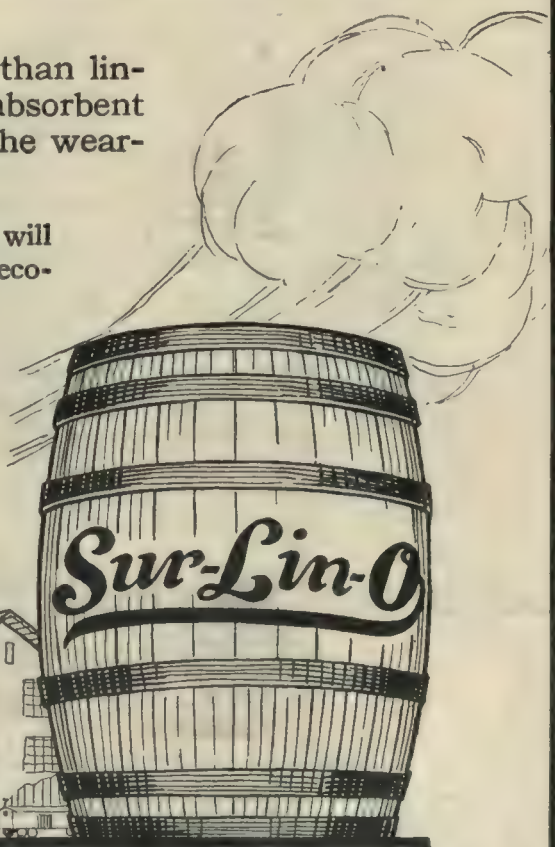
Sur-Lin-O satisfactorily replaces linseed oil as a thinner for paints of any character, Oxide, Carbon, Lead or Zinc, *at a saving of 40%.*

Made on a pure linseed oil base, *Sur-Lin-O* has the same gravity, ease of working and freedom of flow as linseed oil, but its drying and hardening qualities make it unnecessary to add a drier to the paint.

Sur-Lin-O dries with a better gloss than linseed oil, is equally as elastic, is a non-absorbent of moisture and is not detrimental to the wearing properties of paint.

Wherever necessary, our Service Engineers will work with you closely for the proper and economical solution of any painting problem.

Sur-Lin-O is sold to large consumers direct from factory in barrels, halves and fives. Working samples and particulars furnished on request.





St. Louis Surfacer & Paint Co.
Hazel and Union Avenues
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Paints for Large Corporation Users Only



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Brake forgings, riggings, etc.
Car trimmings
Commutators
Controller handles
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